

January 2004

Economic Analysis of Management Alternatives for Personal Watercraft in Gulf Islands National Seashore

Revised Final Report

Prepared for

National Park Service
Environmental Quality Division
Dr. Bruce Peacock

Prepared by

MACTEC Engineering and Consulting, Inc.
(f/k/a LAW Engineering and Environmental Services, Inc.)
3200 Town Point Drive, NW, Suite 100
Kennesaw, GA 30144

BBL Sciences
301 East Ocean Blvd.
Long Beach, CA 90802

and

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Introduction

Historically, NPS classified PWC with other water vessels, which allowed their use when the use of other vessels was permitted. More recently, NPS has reevaluated its methods of PWC regulation. This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Gulf Islands National Seashore (GUIS).

Historically, the National Park Service (NPS) classified personal watercraft (PWC) with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium.¹ In recognition of its duties under the Organic Act and NPS Management Policies, as well as increased awareness and public controversy, NPS reevaluated its methods of PWC regulation. Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns associated with PWC use, NPS proposed a PWC-specific regulation in 1998. The regulation stipulated that PWC would be prohibited in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources and values, other visitor uses, and overall management objectives (63 FR 49,312–17, September 15, 1998). This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Gulf Islands National Seashore (GUIS), located in the northwestern portion of the Gulf of Mexico.

During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000. This amended regulation allows NPS to

¹A compendium is an NPS management tool used specifically by a park superintendent to take actions to address park-specific resource protection concerns.

permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's Compendiums (36 CFR 3.24[b], 2000). The March 2000 regulation provided park units a 2-year grace period in which PWC use could continue after which time PWC would be banned from any park that took no action to promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium.

On August 31, 2000, Bluewater Network et al., filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

A settlement agreement between NPS and Bluewater Network was signed by the District Court on April 12, 2001. The agreement requires all park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 National Environmental Policy Act (NEPA). At a minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. In addition NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. Based on this settlement, PWC use in GUIs was to be prohibited after April 22, 2002 if a final rule permitting their use was not promulgated. After that date, PWC use in GUIs is prohibited until the final rule is published.²

²Under the no-action alternative, PWC use would continue to be banned.

1.1 ORGANIZATION OF REPORT

This report presents NPS' economic analysis of the alternative GUIS PWC regulations under consideration. The report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations at GUIS. Baseline visitation, environmental conditions, and economic activity in GUIS are described in Section 2. The local economic impacts on the region surrounding GUIS are summarized in Section 3. Section 4 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a cost-benefit analysis of the regulatory alternatives. Section 5 provides an analysis of the regulatory alternatives' impacts on small businesses. Uncertainties are addressed in Section 2 for visitation, Section 3 for regional economic impacts, and Section 5 for alternatives' impacts on businesses. In addition, Appendix A describes the principles of economic impact analysis and Appendix B includes a detailed theoretical discussion of the types of benefits and costs associated with PWC restrictions in national parks and the methods used to estimate them.

1.2 PROBLEM ADDRESSED BY REGULATION

The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 1992). In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely private perception of benefits and costs. The major causes of market failure identified in the OMB guidance on Executive Order 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the actions of one economic entity impose

costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting PWC use in national parks is based on externalities associated with their use. For instance, the operation of PWC imposes costs on society associated with noise emissions, air and water pollution emissions, and health and safety risks. Because PWC users have little incentive to consider these external costs, they are likely to make decisions about PWC use without considering these impacts on other people.

If these externalities are internalized to the PWC users generating them, the problem can be mitigated. For example, if PWC users were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions and the market failure would be corrected. However, accurately assigning costs associated with each individual PWC user's actions and enforcing payment is essentially not feasible at this time. Other regulatory options to address the externalities associated with PWC use are far easier to implement and enforce. Some of these options include restricting areas where they are permitted, the time of day when they can be used, and PWC engine type.

The extent to which social welfare improves because of PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses.

The extent to which social welfare improves because of PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses. Thus, the likelihood that a particular regulatory option will improve social welfare in an individual national park unit depends on numerous park-specific factors that influence the level of costs and benefits. Although a given set of restrictions on PWC use in one park may improve social welfare, the same set of restrictions in another park could easily have negative impacts on social welfare. For example, banning PWC in a park where there is little other motorized boating activity may result in large proportionate reductions in noise and emissions, whereas banning PWC in a park with a high level of other motorized boating activity may not have a noticeable effect on noise or emissions levels. In the latter case, the costs to PWC users could be larger than the gains to other park visitors. Thus, it is important to

consider the conditions specific to each individual park in selecting the preferred regulatory alternative for that park.

1.3 CURRENT PWC ACTIVITIES AT GUIS

PWC use at GUIS (including launching, operating, and beaching) is currently banned in all park waters as a result of an administrative determination made by GUIS on April 23, 2002. For the purpose of the analyses provided herein, a ban on PWC use within GUIS is considered the baseline condition. Prior to April 2002, PWC use was permitted within GUIS except where motorized watercraft are expressly prohibited (see below). Section 1.4 describes the proposed regulatory alternatives considered for PWC in GUIS. Figure 1-1 is a map of GUIS identifying the areas described below.

1.4 PROPOSED REGULATIONS

The following three alternatives are being considered for the management of PWC in GUIS:

Proposed Regulations for PWC Use in GUIS

Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed

Alternative B—Reinstate PWC Use Under A Special NPS Regulation With Additional Management Prescriptions

Alternative C—No-Action Alternative—Continue PWC Ban

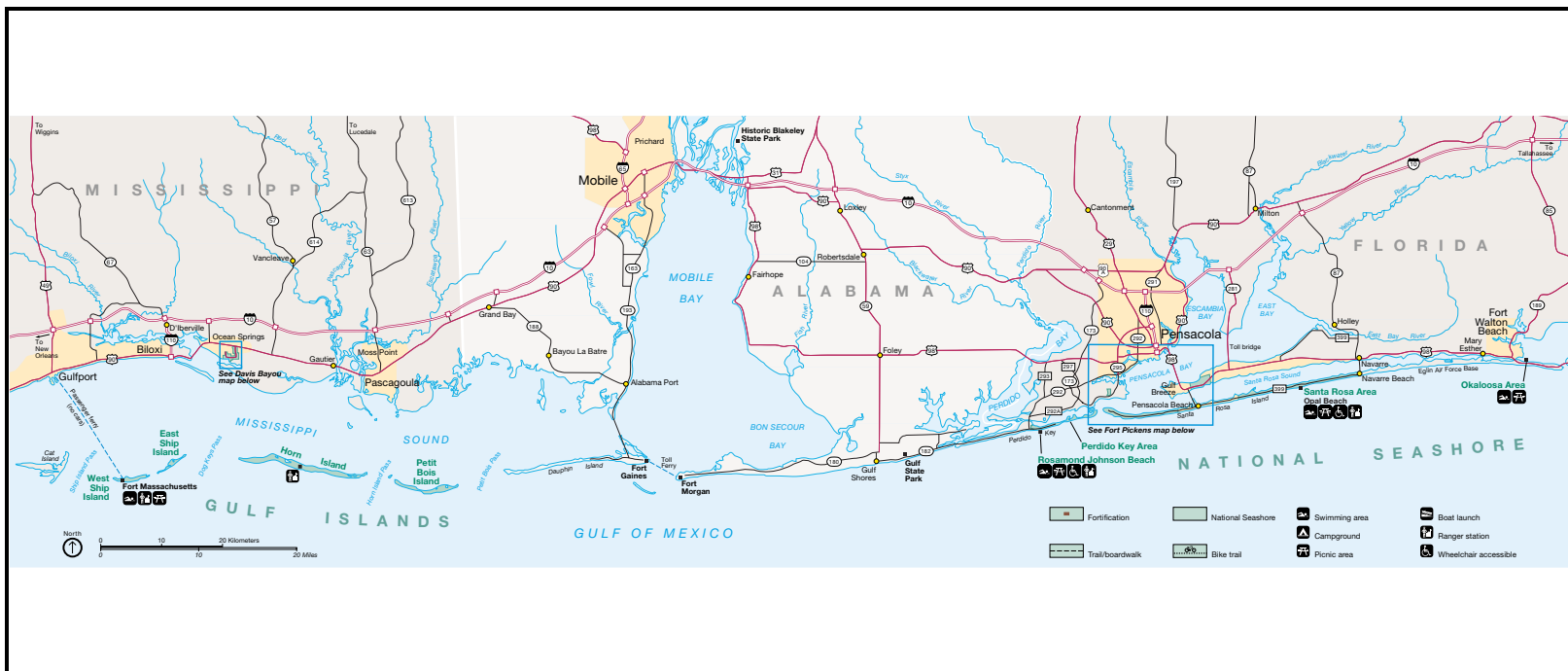
Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed

Under Alternative A, a special NPS regulation would be written to reinstate PWC use as it was managed prior to April 22, 2002. PWC use would be managed in accordance with NPS Management Policies, park practices, and state regulations with no added restrictions. This alternative would allow PWC use within GUIS, and the numbers of personal watercraft would be unrestricted.

PWC use would be reinstated per management policies described in the current Superintendent's Compendium. PWC use would be allowed throughout the national seashore, except in areas where use restrictions had been in place, including:

- No motorized vessels are permitted above the mean high tide line on the designated wilderness islands of Horn and Petit Bois.
- The lakes, ponds, lagoons and inlets of East Ship Island, West Ship Island, Horn Island, Petit Bois Island and Cat Island (lands under NPS management) are closed to the use of motorized vessels.
- The lagoons of Perdido Key within Big Lagoon are closed to all combustion engines.

Figure 1-1. GUIS Regional Map



- The areas 200 feet from the remnants of the old fishing pier and 200 feet from the new fishing pier at Fort Pickens are closed to all boating operations.
- Operating a vessel in excess of 5 mph or creating a wake is prohibited within 500 feet of the Davis Bayou launch ramp, the West Ship Island Pier, the Horn Island Pier, the Fort Pickens Pier, within the buoyed, flat-wake zone at Spoil (Sand) Island, and within the posted area on the north side of Perdido Key near the Fort McRee site.
- Seasonal closures within the seashore to protect wildlife and habitat according to the Superintendent's Compendium.
- Harassing, hunting, capturing or killing any marine mammal, including manatees, is illegal.
- PWC would be allowed to beach at any point along the shore not restricted by the above.

While this rule does not identify specific emission requirements, Environmental Protection Agency (EPA) emission controls provide for increasingly strict standards beginning in model year 1998. Under this alternative, it is assumed that over time, PWC two-stroke engines would be converted to cleaner direct-injected or four-stroke engines in accordance with the EPA's rule (40 CFR Parts 89-91, "Air Pollution Control; Gasoline Spark-Ignition and Spark-Ignition Engines, Exemptions;" Rule, 1996).³ It is the responsibility of the PWC industry to meet these regulations, not the responsibility of individual owners.

All state and federal watercraft laws and regulations would apply to PWC operators including regulations that address reckless or negligent operation, excessive speed, hazardous wakes or washes, hours of operation, age of driver, and distance between vessels.

Alternative B—Reinstate PWC Use Under A Special NPS Regulation With Additional Management Prescriptions

Under Alternative B, a special regulation would be written to reinstate PWC use at the national seashore. Alternative B would include the management actions listed under Alternative A, as well as additional management prescriptions to protect natural and cultural resources, to mitigate PWC safety concerns, to provide for visitor health and safety, and to enhance overall visitor experience.

³Hereto referred to as the "1996 EPA Marine Engine Rule."

In addition to the areas of use and restrictions listed under Alternative A, the following would also apply throughout the park:

- A flat wake zone would be established 300 yards from all park shorelines at the low-water mark with the exception of:
 - ✓ At the West Ship Island Pier a flat-wake zone would extend 0.5 mile from the shoreline and 0.5 mile from either side of the pier
 - ✓ Around all designated wilderness boundaries a flat-wake zone would be established 0.5 mile from the shorelines at the low-water mark.
- No PWC operation would be permitted within 200 feet of nonmotorized watercraft and people in the water. However, other motorized watercraft would be permitted in this 200-foot area at flat wake speed.
- PWC would be allowed to beach at any point along the shore not restricted by the above.

The following prescriptions would be added to management strategies:

- Enhance PWC user and boater education through interpretive talks, onsite bulletins, and brochures given to PWC registrants and visitors who rent personal watercraft.
- Enhance enforcement of federal regulations pertaining to harassment of marine mammals through ongoing water patrols (Marine Mammal Protection Act, Endangered Species Act).

As noted under Alternative A, over time, PWC two-stroke engines would be converted to cleaner direct-injected or four-stroke engines in accordance with the 1996 EPA Marine Engine Rule. It would be prohibited to operate a personal watercraft in park waters that had manufacturer-installed emissions control equipment removed.

All state and federal watercraft laws and regulations would apply to PWC operators, including regulations that address reckless or negligent operation, excessive speed, hazardous wakes or washes, hours of operation, age of driver, and distance between vessels, as described under Alternative A.

Alternative C—No-Action Alternative (Continue PWC Ban)

Under the no-action alternative, no unit-specific rule would be promulgated to reinstate PWC use in GUIs. Therefore PWC use would be prohibited in GUIs permanently, in accordance with *Bluewater Network v. Stanton*, No. CV02093 (D.D.C. 2000), the

settlement agreement approved by the court on April 12, 2001. For clarification, the park boundaries are the following:

Florida District

- Perdido Key extends on the north to the Intracoastal Waterway (ICW) and extends on the south 1 mile from the low tide line of the island.
- Fort Pickens' boundary extends on the north to the ICW and extends on the south 1 mile from the low tide line of the island.
- Naval Live Oaks boundary extends 100 yards from the low tide line.
- Santa Rosa boundary extends on the north to the Intracoastal Waterway and extends on the south 1 mile from the low tide line of the island.
- Okaloosa Day Use Area has no water boundaries.

Mississippi District

- Cat Island has no PWC restrictions around the island.
- Davis Bayou area boundary extends from the public boat ramp and waters eastward.
- Boundaries of West Ship, East Ship, Horn, Petit Bois, and Sand Islands extend 1 mile to the north and south of the islands.

2

Description of PWC Use in Gulf Islands National Seashore

Currently PWC use in GUIS is banned. Therefore, there are no baseline impacts of PWC on water and air quality, soundscapes, wildlife and wildlife habitats, and cultural resources within the park.

GUIS is located in the northwestern portion of the Gulf of Mexico and includes a widely spaced chain of barrier islands extending nearly 150 miles from Cat Island in Mississippi to the eastern portion of Santa Rosa Island in Florida, excluding the barrier islands in Alabama (see Figure 1-1). GUIS was authorized in January 1971 to preserve for public use and enjoyment certain areas possessing outstanding natural, historic, and recreational values. The seashore includes white sand beaches, coastal salt marshes and bayous, maritime forests, and a Naval Live Oak Reservation, as well as prehistoric shell mounds and historic fortifications dating from the 1820s up to the 1940s.

GUIS is the nation's largest national seashore and consists of 135,607 acres, of which 19,445 acres are land area. The park is divided into 11 separate units, five in Mississippi and six in Florida. Horn Island and Petit Bois Island, consisting of approximately 1,800 acres, are federally designated wilderness areas.

Water boundaries of GUIS vary by location. The Intracoastal Waterway (ICW) and ship channels are excluded from park boundaries. In Florida, on Santa Rosa Island, around the Fort Pickens and Santa Rosa areas of the Seashore, and on Perdido Key, around the Seashore's Perdido Key area, the boundary extends on the north to the south boundary of the ICW and extends on the south 1 mile from the low tide line of the offshore islands. In the Naval Live Oaks area, the boundary extends 100 yards from the low

tide line both on the north and south side of the unit. At the Okaloosa area, the park has no water boundary.

In Mississippi, the boundary is continuous beginning at the eastern boundary of the Gulfport Ship Channel west of West Ship Island to 1 mile to the east of Petit Bois Island and extending 1 mile to the north and 1 mile to the south from the low tide line of the offshore islands of Horn, Petit Bois, and East and West Ship. In the Davis Bayou area, the boundary extends from the public boat ramp and water eastward. At Cat Island, the water boundary is the mean high water mark.

2.1 PWC USE, AREA ACCESS, MAINTENANCE, AND ENFORCEMENT AT GUIs

Although PWC use is currently banned in GUIs (see Section 1.3), this section reviews PWC access, maintenance, and enforcement prior to the ban. According to NPS staff, PWC were first used in GUIs between 10 and 15 years ago, and PWC use had increased since that time until the ban. The heaviest PWC use season was from April to October, but some PWC use continued year-round because of the warm climate. The Davis Bayou area in the Mississippi District has a boat launch ramp that prohibits PWC. Educational cards about the PWC ban, and identifying the park boundaries, are presented to visitors with PWC near the park.

Prior to the April 2002 ban, facility maintenance and law enforcement activities associated with PWC use at GUIs were incidental to other park services. GUIs did not provide any facilities solely for PWC users. A boat launch ramp at the Davis Bayou area in Mississippi District previously allowed PWC access. Watercraft access outside GUIs is provided by several local marinas and launch ramps in Pensacola Bay and Mississippi Sound.

Prior to the ban, PWC accounted for 58 percent of all watercraft citations in the Mississippi District of GUIs, while comprising less than 5 percent of recreational boats in the Mississippi District (NPS, 2002b). Table 2-1 summarizes watercraft citation data for the Mississippi District. Similar data were not available for the Florida District.

Table 2-1. GUIS Mississippi District Watercraft Boating Violations, 1997–2001

Year	All Watercraft Violations	PWC Violations
1997	242	165
1998	246	166
1999	287	137
2000	175	97
2001	177	84
Total	1,127	649

Source: National Park Service, 2002b. Administrative Determination: To Allow 36 CFR 3.24(a) (2000), Use of Personal Watercraft in Park Waters, to Take Effect in Gulf Islands National Seashore. Gulf Islands National Seashore, 2002.

2.2 VISITATION DATA

In Sections 3 and 4, NPS presents analyses of the economic impacts and the social benefits and costs of PWC use under alternative regulations in GUIS from 2003 through 2012. To support the development of these estimates, Section 2.2 presents projections of baseline PWC and non-PWC visitation for this period and a discussion of the methodology used to calculate the projections. The projected baseline represents visitation to GUIS after imposition of the April 2002 ban on PWC use in GUIS (see Section 1.3). In addition, projected visitation expected to have occurred in the absence of the ban is presented.

2.2.1 Historical GUIS Visitation Data

NPS reports that recreational visitation¹ in the year 2002 was an estimated 4,561,862 people, with peak visitation in June and July. Table 2-2 presents the 1998 to 2002 monthly recreational visitation estimates for GUIS. Table 2-3 shows annual recreational visitation to GUIS from 1979 to 2002. Since 1996, when damage from a hurricane resulted in the closure of some park units, visitation to the park has been relatively stable.

¹A recreational visit is defined as the “entry of a person onto lands or waters administrated by the NPS for recreational purposes” (NPS, 1999). Recreational visits do not include “nonrecreational” visits (defined as “through traffic, trades people with business in the park, and government personnel (other than NPS employees) with businesses in the park”) (NPS, 1999).

Table 2-2. Monthly Recreational Visitation to GUIS, 1998–2002

	1998	1999	2000	2001	2002
January	242,048	234,247	200,525	222,751	233,647
February	261,651	306,088	272,797	255,639	291,894
March	371,942	366,398	356,600	346,257	350,978
April	384,411	446,170	417,569	408,725	395,967
May	566,031	572,938	572,559	496,679	572,767
June	587,499	519,900	588,139	613,312	552,857
July	594,465	624,195	642,518	620,792	623,034
August	487,953	470,425	489,500	492,105	472,884
September	318,757	372,837	353,501	337,157	321,857
October	54,827	275,337	284,220	273,709	224,576
November	212,540	228,954	220,800	270,115	294,846
December	211,177	179,784	191,867	212,659	226,555
Total	4,293,301	4,597,273	4,590,595	4,549,900	4,561,862

Source: National Park Service, 2002c. NPS Visitations Database—Park Report. Park Visitation Report, Gulf Island NS.
<http://www2.nature.nps.gov/npstats/parkrpt.cfm> Date 10/2/2002.

Table 2-3. Annual Recreational Visitation to GUIS, 1979-2001

Year	Total Visitation	Year	Total Visitation
1979	2,965,041	1991	4,987,978
1980	2,507,507	1992	5,427,729
1981	3,316,477	1993	5,456,294
1982	3,507,438	1994	5,069,495
1983	4,060,386	1995	4,520,356
1984	5,803,384	1996	2,581,037
1985	9,880,814	1997	4,697,014
1986	7,646,201	1998	4,293,301
1987	4,826,892	1999	4,597,270
1988	5,197,899	2000	4,590,595
1989	4,458,368	2001	4,549,900
1990	4,873,730	2002	4,561,862

Source: National Park Service, 2002c. NPS Visitations Database—Park Report. Park Visitation Report, Gulf Island NS.
<http://www2.nature.nps.gov/npstats/parkrpt.cfm> Date 10/2/2002.

2.2.2 Historical GUIS Watercraft Visitation Data

Prior to the ban in 2002, NPS did not conduct a formal analysis of PWC use in GUIS. However, NPS staff made informal observations and estimates regarding the level of PWC use in GUIS. Absent additional information on PWC use in GUIS, NPS assumes that GUIS park staff have the best available data on PWC visitation to the park. Thus, GUIS park staff estimates of PWC use were used to develop estimates of PWC use prior to the ban in 2002.

According to NPS staff, approximately 108,200 recreational boating visitors used the Mississippi district of GUIS in 2001, or 14 percent of all visitors to the Mississippi District. This estimate is based on a count of 24,589 boats and an assumption of 4.4 persons per vessel. In 2002, 16,196 boating vessels visited the Mississippi District of GUIS (EDAW, 2003). NPS staff estimate that, prior to the ban, approximately 4 percent of boats in the Mississippi District were PWC. Based on this estimate, 984 PWC were used in the Mississippi District in 2001 and 648 PWC would have been used in 2002 in the absence of a ban. Using an average of boating estimates for 2001 and 2002, PWC use in the Mississippi District is estimated to be 816 PWC per year (EDAW, 2003).

NPS has not performed a formal count of boat use in the Florida District, but can estimate boat use in the Florida District based on data available from the Mississippi District. Assuming that the same proportion of boaters used the Florida and Mississippi Districts (14 percent of all visitors), and that the boating parties are the same size in both districts (4.4 people per vessel), approximately 122,640 boats used the Florida District in 2001 and 79,360 boats visited the Florida District in 2002. NPS staff estimate that only about 0.5 percent of all boats in the Florida District were PWC prior to the ban. Using this estimate, 613 PWC were used in the Florida District in 2001 and 397 PWC would have been used in the Florida portion of GUIS in 2002 in the absence of a ban. Using an average of boating use from 2001 and 2002, PWC use in the Florida District is estimated to be 505 PWC per year (EDAW, 2003).

Estimates of group size for PWC users were not available for GUIS. Other parks have estimates of group size for PWC users, including Lake Meredith National Recreation Area, Glen Canyon National Recreation Area, and Lake Mead National Recreation Area. The

estimated group size for PWC users at these parks ranges from 3.0 to 4.5 people per PWC (MACTEC et al., 2002a, b, 2003). In the absence of park-specific data for the group size of PWC users, NPS assumes a group size of 4.4 people per PWC in GUIs, which is consistent with park staff estimates of the average number of people per vessel. Based on this assumption, NPS estimates that annual PWC use in the Florida District is 2,222 people and PWC use in the Mississippi district is 3,590 people per year. Summing across both districts, the total estimate for average PWC use in GUIs is 5,812 people per year, or about 0.1 percent of average visitation in 2001 and 2002.²

2.2.3 Projected Visitation

Methodology for Projecting Visitation

To project baseline PWC and non-PWC visitation for the years 2003 through 2012, NPS used the following methodology:

Baseline

1. Calculate average recreational visitation over the five most recent years with data available (1998–2002).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using estimates of PWC use in 2001–2002 relative to total recreational visits.
3. Project baseline non-PWC visitation for the period 2003–2012 by allowing non-PWC visitation to change from the 1998–2002 average at the population growth rate for the areas from which most visitors to the park originate. The growth rate from 1990–2000 yields an average annual growth rate of 1.63 percent.
4. Assume there would be no PWC use in 2003–2012 under baseline conditions because of the current ban on PWC use in GUIs.
5. Project visitation by former PWC users by assuming a certain fraction will continue to visit GUIs to engage in activities other than PWC use following the ban. These percentages will typically be based on professional judgment, because of the absence of a formal study of PWC use in GUIs.

²To prevent multiple rounding errors, more digits than those presented here were carried in calculating the values in this report.

Without Ban

1. Calculate average recreational visitation over the five most recent years with data available (1998–2002).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using an estimate of 5,812 PWC users. This results in an estimate of PWC users accounting for about 0.1 percent of average visitation in 2001 and 2002.
3. Estimate PWC visitation for 2003–2012 by using the estimates of annual growth in PWC use derived from PWC registration data in counties surrounding GUIs.³ Based on this methodology, PWC use is assumed to increase at an annual rate of 9.6 percent between 2003 and 2012.

Recent trends suggest that visitation to GUIs by non-PWC users will increase by approximately 1.6 percent annually.

Projecting Visitation for 2003 through 2012

Following the methodology outlined above, NPS calculated GUIs average annual recreational visitation for 1998 through 2002 to be 4,518,586. According to NPS estimates outlined above, approximately 0.1 percent of 2001–2002 visitors would have used PWC in GUIs in the absence of a ban. Assuming that the percentage of PWC visitors remained constant over time, this implies an annual average 5,765 PWC users and 4,512,821 non-PWC users from 1998 to 2002 in the absence of a ban.⁴ NPS projects that non-PWC visitation will grow at the rate of population growth for the counties adjacent to the park.⁵ Using Census Bureau (2002) data on population growth in the local counties yields a weighted average annual growth rate of 1.63 percent. This is well above the national average of 0.9 percent.

Finally, some of the former PWC users who can no longer use a PWC in GUIs may have continued to visit GUIs to pursue other types of recreation. It was assumed that 50 percent of those that stopped using PWC in GUIs in the baseline (as a result of the ban) will continue to visit the park in each future year.⁶ This percentage

³Based on 1997–2001 Florida county PWC registration data in Santa Rosa, Okaloosa and Escambia counties.

⁴PWC were banned from GUIs in 2002, but since the PWC estimates are calculated as an average of the number of projected PWC users in 2001 and 2002 the visitation data for 2002 was included in calculating baseline non-PWC visitation.

⁵Escambia, Santa Rosa, and Okaloosa Counties, Florida; Jackson and Harrison Counties, Mississippi.

⁶It was assumed that a constant number of former PWC users would be willing to continue visiting the park for other activities in all future years.

is based on professional judgment and reflects the uniqueness of GUIS in comparison with nearby recreation areas. Based on the estimated regional population growth rate and the assumed percentage of former PWC users who continue to visit the park for other activities, Table 2-4 shows the projected baseline visitation for GUIS from 2003 to 2012. To estimate the incremental impacts of the alternative regulations, the change in visitation relative to these baseline visitation estimates must be projected. Estimates of the incremental impacts are discussed in Sections 3 through 5.

Table 2-4. Projected Baseline Visitation to GUIS, 2003–2012

Year	PWC Users	Non-PWC Users			Total Visitation
		Current Non-PWC Users	Former PWC Users ^a	Total Non-PWC Users	
2003	0	4,586,431	3,159	4,589,590	4,589,590
2004	0	4,661,242	3,159	4,664,401	4,664,401
2005	0	4,737,273	3,159	4,740,432	4,740,432
2006	0	4,814,545	3,159	4,817,704	4,817,704
2007	0	4,893,077	3,159	4,896,235	4,896,235
2008	0	4,972,889	3,159	4,976,048	4,976,048
2009	0	5,054,004	3,159	5,057,163	5,057,163
2010	0	5,136,442	3,159	5,139,601	5,139,601
2011	0	5,220,224	3,159	5,223,383	5,223,383
2012	0	5,305,373	3,159	5,308,532	5,308,532

^aThis category represents visitors who used PWC in GUIS prior to the ban, but would be willing to continue visiting the park to engage in alternative activities following the ban. This value is calculated by assuming that the number of former PWC users continuing to visit GUIS is constant and is equal to 50 percent of the number of people projected to have used PWC in GUIS in the absence of a ban.

2.2.4 Sources of Uncertainty in Visitation Projections

NPS estimates of non-PWC visitation in the years 2003 through 2012 are based on a number of assumptions. In addition, a variety of unpredictable circumstances could affect visitation in a particular year. In general, visitation to GUIS in a specific year will depend on many factors, including

- economic conditions,
- weather,
- natural resource conditions,

- national and state regulations that may affect PWC use or prices,
- alternative recreational activities available, and
- other infrequent events that may occur in a given year that affect visitation.

Although many of these factors are difficult to predict, a recent regulation enacted by the U.S. Environmental Protection Agency (EPA) in 1996 may affect PWC use nationally and in GUIs. The 1996 EPA rule for New Gasoline Spark-Ignition Marine Engines⁷ (hereafter referred to as the 1996 EPA Marine Engine Rule) requires PWC (and other spark-ignition [SI] marine engine) manufacturers to reduce emissions by 75 percent from the 1998 model year until the 2006 model year (*Federal Register*, 1996). In their analysis of the rule, EPA predicted that the emissions from all of the regulated engines in use will decrease by approximately 75 percent from baseline emission levels by the year 2025. The delay in actual emission reductions for machines in use is due to the long lives of some marine engines. EPA predicts that complete fleet turnover for some engines may not occur until 2050. However, EPA assumes that the life cycle for PWC is 10 years, considerably shorter than their assumptions for the life cycles of some of the other SI marine engines covered by the rule (*Federal Register*, 1996). According to the Personal Watercraft Industry Association (PWIA), PWC manufacturers have already reduced the emissions of PWC significantly, and many of the newer PWC models already comply with the 1996 EPA Marine Engine Rule (PWIA, 2002).

Without additional data, it is difficult to predict whether the assumptions used by NPS will bias the projections upward or downward.

It is also possible that publicity surrounding the proposed NPS PWC rules may have affected PWC use. PWC sales have been declining nationally over the past few years. However, the sales decline began in 1996, which is before NPS first proposed rules restricting PWC in national parks. This suggests that other factors also may be involved in the national recent sales decline. Nonetheless, it is possible that baseline PWC use would have been higher in the absence of recent negative publicity.

⁷In 1996, EPA promulgated a rule to control exhaust emissions from new spark-ignition marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions-compliant (i.e., to reduce hydrocarbon [HC] emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

NPS identified the following additional uncertainties in the projections of baseline visitation:

- The estimates of 2001 PWC use and 2002 PWC use⁸ in the absence of the ban represent the park's best estimate of use. However, GUIS staff have not conducted a rigorous count of PWC throughout the season.
- In generating an estimate of the number of annual PWC users, NPS multiplied the estimate of PWC per year by an assumed group size of 4.4 people per party. To the extent that the actual average group size at GUIS differs from 4.4 for PWC users, the estimate of total PWC users may be biased upward or downward.
- NPS projects growth in non-PWC visitation based on population growth in the surrounding counties. As discussed above, a number of factors could affect visitation in any one year or the trend in visitation over time. However, NPS believes that regional population growth, which should be related to economic conditions, represents the best available proxy for change in visitation.
- NPS makes assumptions about the number of former PWC users who will return in the future under the existing ban. These assumptions represent our best estimate, but the actual percentage of former PWC users that continue to visit the park for alternative recreation activities may be higher or lower.
- The change in future PWC use is estimated using boat and PWC registrations in Florida and Mississippi. These measures are only an approximation for the trend in GUIS PWC use.

2.3 ALTERNATE LOCATIONS FOR PWC USE IN THE FLORIDA-MISSISSIPPI REGION

Alternate locations for PWC use in the vicinity of GUIS are numerous, largely because Pensacola Bay and Mississippi Sound, the Gulf of Mexico, and several major river systems provide opportunities for PWC use. GUIS park staff estimate that of the 170 square miles of water available in the Florida portion of the park in Pensacola Bay, the PWC closure at GUIS removes only 18 square miles. In Mississippi, GUIS park staff estimate that, of the 789 square miles of open water between GUIS and the mainland, only 28 square miles are closed to PWC. Mobile Bay in Alabama is also

⁸The 2002 PWC use estimate may underestimate use since it is based on a total watercraft use, including PWC, after PWC had been banned. However, factors other than the ban on PWC contribute to the drop in the number of watercraft visiting GUIS in 2002 are captured in this estimate as well.

available for PWC use. There are no NPS units with significant PWC use in the vicinity of GUIS.

2.4 OTHER MAJOR SUMMER ACTIVITIES IN GUIS

Popular recreation activities at GUIS include biking, bird watching, boating, camping, fishing, hiking, interpretive programs, kayaking, nature walks, scuba diving, snorkeling, stargazing, swimming, visiting wilderness areas, visiting historic areas, and wildlife viewing.

2.5 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF PWC USE IN GUIS

The following section provides an assessment of the natural resources at GUIS and the potential impacts to park resources under the proposed PWC management alternatives. Interviews with GUIS personnel and information on PWC impacts reported in the literature provide the basis for this assessment. Detailed information on the definitions for each resource are provided in the EA. The following impact thresholds are general descriptions of those established in the GUIS EA (NPS, 2003b) in order to describe the relative changes in resources:

- Negligible: Impacts are not detectable, below resource standards or criteria, and within historical or baseline conditions of the park.
- Minor: Impacts would be detectable but would be below the resource standards or criteria and within historical or desired conditions of the park.
- Moderate: Impacts would be detectable but at or below the resource standards or criteria; however, conditions would be altered on a short-term basis.
- Major: Impacts would be detectable and frequently altered from historical or baseline conditions in the park, and would exceed resource standards or criteria slightly and singularly on a short-term and temporary basis.
- Impairment: Impacts would be detectable and substantially and frequently altered from historical or baseline conditions in the park, and would frequently exceed resource standards or criteria on a short-term and temporary basis. The impacts would involve deterioration of the park's resources over the long term, to the point that the park's purpose could not be fulfilled.

Impacts have been assessed using current conditions (i.e., the PWC ban) as the baseline and comparing them with the conditions likely under the proposed alternatives (see Section 1.4). Cumulative impacts from all sources are described where they differ from PWC-specific impacts.

2.5.1 Water Quality

Most research on the effects of PWC use on water quality focuses on the impacts of two-stroke engines and assumes that impacts caused by these engines also apply to the PWC powered by them. The conventional (i.e., carbureted) two-stroke PWC engine mixes air, gasoline, and oil in the combustion chamber, expels exhaust gases from the combustion chamber, and discharges as much as 30 percent of the unburned fuel mixture as part of the exhaust (California Air Resources Board, 1999). At common fuel consumption rates, an average two-hour ride on a PWC may result in the discharge of three gallons (11.34 liters) of fuel into the water (VanMouwerik and Hagemann, 1999).

Contaminants released into the environment as a result of PWC use include those present in the raw fuel and those formed during combustion. Fuel used in PWC engines contains many hydrocarbons, including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX) and methyl tertiary butyl ether (MTBE). Unburned PWC fuel does not contain appreciable levels of polycyclic aromatic hydrocarbons (PAHs), but several PAHs are formed as a result of fuel combustion (i.e., phenanthrene, pyrene, chrysene, benzo(a)pyrene, and acenaphthylene) (VanMouwerik and Hagemann, 1999). Other hydrocarbons produced during incomplete combustion of PWC fuel include formaldehyde, acetaldehyde, diesel particulate matter (PM), and 1,3-butadiene (EPA, 1994).

Unburned fuel and combustion by-products are released to the environment in PWC exhaust. Because of differences in chemical and physical characteristics, BTEX released into the water readily evaporates from water to air, whereas most PAHs and MTBE do not. Thus, water quality issues associated with BTEX in the water column are less critical than those associated with PAHs and MTBE (VanMouwerik and Hagemann, 1999).

Compounds released in water as a result of PWC use are known to cause adverse health effects in humans and aquatic organisms. Exhaust emissions from two-stroke engines specifically have been shown to cause toxicological effects in fish (Tjarnlund et al., 1995, 1996; Oris et al., 1998). Sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994; Arfsten, Schaeffer, and Mulveny, 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (NCER, 1999) has demonstrated that toxicity may vary due to a number of factors including length of exposure, turbidity, humic acid and organic carbon levels, location of the organism relative to the water or sediment surface, and weather (NCER, 1999). For example, increased turbidity and organic carbon levels tend to reduce toxicity, while increased length of exposure and distance to water surface tend to increase toxicity of fuel-related compounds.

New PWC engines, including direct-injected two-stroke engines and four-stroke engines, will decrease the amount of unburned fuel that escapes with PWC exhaust and will result in decreased emissions (VanMouwerik and Hagemann, 1999). As a result of EPA's 1996 rule requiring cleaner spark-ignited marine engines,⁹ a 50 percent reduction of current hydrocarbon emissions from these engines is expected by 2020, and a 75 percent reduction in hydrocarbon emissions is expected by 2025 (*Federal Register*, 1996).

Baseline Water Quality Conditions at GUIS

The Pensacola Bay watershed has been affected by numerous sources resulting in a water body that does not have the natural biodiversity and productivity expected of a system with its complexity. Nonpoint source and point source pollution continue to degrade sediment and water quality throughout much of the bay. Aquatic and wetland habitats have been lost and degraded. Nonpoint sources include urban storm water runoff, agricultural runoff, swamp drainage, groundwater seepage into surface waters, watercraft (including boats and PWC [outside the park boundary]),

⁹In 1996, EPA promulgated a rule to control exhaust emissions from new spark-ignition marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions compliant (i.e., to reduce hydrocarbon emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

automobiles, and aircraft. Point sources include effluents from municipal-private domestic wastewater treatment plants and industrial plants (FDEP, 2002). Fort Pickens Jetty is monitored by the Florida Department of Environmental Protection and has a normal range for dissolved oxygen, coliform count, and salinity (FDEP, 2003).

The Mississippi Sound watershed's primarily pollutant is nonpoint source releases from urban runoff and septic tanks, watercraft, automobiles, and aircraft. Point source pollutant releases include discharges from nearby cities and industrial areas.

Because PWC are currently banned from the park, their use does not have any impact on water quality.

Potential Impact of PWC Use on Water Quality Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed. According to the GUIS EA (NPS, 2003b), impacts to water quality on a PWC-specific and cumulative basis are predicted to be negligible for all pollutants in all areas of the national seashore in 2002 and 2012.¹⁰ In 2012, impacts from watercraft are expected to be lower than in 2002 due to reduced emission rates. NPS concludes that Alternative A would not result in an impairment of water quality.

Alternative B—Reinstate PWC Use Under A Special NPS Regulation With Additional Management Prescriptions. As described in the GUIS EA, reinstating PWC use with additional management restrictions would have the same impacts, both PWC-specific and cumulatively, as Alternative A. NPS concludes that Alternative B would not result in an impairment of water quality.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to water quality from PWC would occur within GUIS if the ban continued.

2.5.2 Air Quality

Air quality and visibility can be affected by emissions from two-stroke engines such as PWC motors. Emissions from PWC in

¹⁰See GUIS EA (NPS, 2003b) for a description of the methodology used in determining the level of impacts.

national parks are one of many potential (albeit, relatively small) sources of these air quality and visibility impairments.

Recreational marine engines, including PWC and outboard motors, contribute approximately 30 percent of national nonroad engine emissions and are the second largest source of nonroad engine hydrocarbon emissions nationally (*Federal Register*, 1996).

According to the results of a 1990 inventory of emissions in California, watercraft engines produced an estimated 141 tons of smog-forming reactive organic gases (ROG) 1,063 tons of carbon monoxide (CO), and 31 tons of nitrogen oxides (NO_x) emitted per day (Kado et al., 2000). A comparison of emissions from conventional and direct injected two-stroke engines with four-stroke engines found that the new four-stroke engine has considerably lower emissions of PM, PAHs, and genotoxic activity (Kado et al., 2000). Based on a comparison with a typical 90-horsepower engine it is estimated the ban of conventional two-stroke engines would result in a four-fold decrease in smog-forming pollution per engine (VanMouwerik and Hagemann, 1999).

Although PWC engine exhaust is usually routed below the waterline, some of the exhaust gas is released to the air and may affect air quality. The combustion process results in emissions of air pollutants such as hydrocarbons (PAHs and VOCs such as BTEX and MTBE), NO_x, PM, and CO (Kado et al., 2000). PWC also contribute to the formation of ozone (O₃) in the atmosphere, which is formed when hydrocarbons react with NO_x in the presence of sunlight (EPA, 1993). Additionally, up to one-third of the fuel delivered to conventional two-stroke engines remains unburned and is discharged as part of the waste stream. The lubricating oil also is used once and is expelled as part of the exhaust. Some of the compounds (e.g., VOCs) in the unburned fuel may transfer from water to air and become air pollutants. (See Section 2.5.1 for further discussion of burned and unburned constituents of PWC emissions.) Several compounds in PWC exhaust are known to adversely affect both human and plant life. They may adversely affect park visitor and employee health, as well as sensitive park resources. Ozone causes respiratory problems in humans, including coughing, airway irritation, and chest pain during inhalation. Ozone also is toxic to sensitive species of vegetation. It causes visible foliar injury, decreased plant growth, and increased plant

susceptibility to insects and disease (EPA, 1993). Carbon monoxide can interfere with the oxygen-carrying capacity of blood, resulting in insufficient oxygenation of tissues. Adverse health effects have been associated with exposure to airborne particulate matter, especially PM less than 10 μm aerodynamic diameter (PM_{10}) (Kado et al., 2000). NO_x contributes to acid deposition effects on plants, water, and soil. NO_x and PM emissions associated with PWC use can reduce visibility and thus visitor enjoyment.

Baseline Air Quality Conditions at GUIS

GUIS is designated as a federal Class II “floor” air quality area, a designation under the Clean Air Act that allows only moderate amounts of degradation of the existing air quality condition and does not allow the park to be reclassified as a Class III park where increases to air pollution are allowed (NPS, 2002a). Air quality at GUIS is generally good (NPS, 2002b). NPS does not operate air quality monitoring stations in the vicinity of GUIS. Air quality monitoring data have not been collected to determine the effects of combustion engine use in the park. Sources of air pollution within GUIS include automobiles, watercraft, and airplanes. Because PWC are currently banned at GUIS, they have no impact on air quality.

Potential Impact of PWC Use on Air Quality Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed. According to the GUIS EA, this alternative would have negligible adverse impacts to existing air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. The risk from PAHs would also be negligible. On a cumulative basis, this alternative would have negligible adverse impacts for PM_{10} and NO_x and moderate adverse impacts for CO and HC in 2002 and 2012 in the Florida district. This alternative would have negligible adverse impacts for PM_{10} , HC, and NO_x in 2002 and 2012 in the Mississippi district. CO impacts would be minor in 2002 and would increase to moderate in 2012.

Minor adverse impacts to air quality related values (such as perceptible visibility impacts or ozone injury to plants) from PWC would occur in both 2002 and 2012 in both districts of the national seashore. On a cumulative basis, impacts to air quality related

values would be moderate adverse from emissions from motorized boats and PWC in the Florida district, and minor adverse impacts to air quality related values from cumulative emissions from motorized boats and PWC would occur in both 2002 and 2012 in the Mississippi district.

NPS concludes that Alternative A would not result in an impairment of air quality or air quality related values.

Alternative B—Reinstate PWC Use Under A Special NPS Regulation With Additional Management Prescriptions. As described in the GUIS EA, reinstating PWC use with additional management restrictions would have the same impacts, both PWC-specific and cumulatively, as Alternative A. NPS concludes that Alternative B would not result in an impairment of air quality or air quality related values.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to air quality or air quality related values from PWC would occur within GUIS if the ban continued.

2.5.3 Soundscape

PWC emit up to 105 dB per unit at 82 feet, which may disturb park visitors and wildlife. NPS has established a noise limit of 82 dB at 82 feet. Noise from PWC may be more disturbing than noise from a constant source at 90 dB due to rapid changes in acceleration and direction of noise (EPA, 1974) and their ability to be driven in shallow water close to the shoreline. However, the newer, EPA 2006 compliant models of PWC may be up to 50 to 70 percent quieter than the older models (PWIA, 2002).

Baseline Soundscape Conditions at GUIS

One aspect of experiencing GUIS's resources is the ability to hear the sounds associated with its natural resources, often referred to as "natural sounds" or "natural quiet." Natural sounds generally include the naturally occurring sounds of winds in the trees, calling birds, and the quiet associated with still nights. "Noise" is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them. GUIS wilderness areas are managed to "to perpetuate an undisturbed environment that possess an atmosphere of solitude, as well as negligible evidence of resource impairment" (NPS Management

Policies 6.3.4.3, as quoted in NPS, 2002b). Although the park's wilderness designation extends to the shoreline, PWC operating outside of the wilderness area could produce impacts to wilderness characteristics and values. Wilderness users could be subject to the intensity and frequency of PWC noise, disturbing their wildlife experience. According to NPS management policies, park management has the authority and responsibility to manage influences originating outside of wilderness boundaries in an effort to protect wilderness values (NPS Management Policies 6.3.4.1 as quoted in NPS, 2002b).

Typical sounds at GUIS include waves, wind in trees, visitors talking, road noise from vehicles in the national seashore and on adjacent roads, aircraft from Pensacola Naval Air Station, and other watercraft. High-use areas, such as around bridges and boat launches, have higher ambient noise levels, particularly from boats launching and landing. Most watercraft activity within GUIS involves small- to medium-sized recreational and commercial vessels used as transportation or fishing platforms. Located adjacent to the ICW, GUIS is also traversed by numerous transport vessels, including tug-barge combinations. The sound signatures of these vessels, are transient and low-pitched. Most areas of GUIS in Florida are accessible by motor vehicle and traffic can be fairly constant during busy visitor periods. In addition, certain sites are subjected to military aircraft overflights given the proximity to Pensacola Naval Air Station.

Because PWC are currently banned at GUIS, they have no impact on the natural soundscape.

Potential Impact of PWC Use on Soundscape Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed. According to the GUIS EA, this alternative would have minor to moderate adverse impacts, both PWC-specific and cumulatively, predominately on busy days during the high use season. NPS concludes that Alternative A would not result in an impairment of soundscape values.

Alternative B—Reinstate PWC Use Under A Special NPS Regulation With Additional Management Prescriptions. As described in the GUIS EA, reinstating PWC use with additional

management restrictions would have the same impacts, both PWC-specific and cumulatively, as Alternative A. NPS concludes that Alternative B would not result in an impairment of soundscape quality.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to the natural soundscape from PWC would occur within GUIS if the ban continued.

2.5.4 Wildlife and Wildlife Habitat

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success. These effects are believed to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow water (WDNR, 2000). PWC can access sensitive shorelines and disrupt riparian habitats critical to wildlife. When run in very shallow water, PWC can disturb the substrate, including aquatic plants, benthic invertebrates, and, at certain times of year, spawning and nursery areas for fish.

Waterfowl and nesting birds may be particularly sensitive to PWC because of their noise, speed, and unique ability to access shallow water. This may force nesting birds to abandon eggs during crucial embryo development stages, keep adults away from nestlings and thus prevent them from defending the nest against predators, and flush other waterfowl and migratory avian species from habitat, causing stress and associated behavior changes (WDNR, 2000; Burger, 1998; Rodgers and Smith, 1997).

Baseline Wildlife and Wildlife Habitat Conditions at GUIS

GUIS provides a variety of coastal habitats, including ocean (Gulf of Mexico), dune strand (includes primary dunes), dune-swale, forest-marsh, salt marsh, sound or bay, mainland forest, and transition interfaces between each of these habitats. The descriptions below are from the GUIS web page (www.nps.gov/guis/home.htm).

Although conditions on the barrier islands and on the mainland can be dynamic and even harsh, plants and animals have adapted to the heat, sun, and unpredictable weather extremes, including hurricanes. Featured wildlife include birds, small mammals such as

beach mice, aquatic mammals such as otters, marine mammals such as dolphins, reptiles, amphibians, crustaceans, and fish. Because of the abundance and protected status of animals at GUIs, the park is designated as a National Watchable Wildlife Area (see Section 2.5.5). There are currently no adverse impacts to wildlife populations from PWC in GUIs because they are banned in the park. The ban also eliminates any potential impacts to wildlife resulting from PWC-associated noise or emissions.

Birds. Over 280 species of birds, including songbirds, waterfowl, wading birds, birds of prey, marine birds, and shorebirds, use the islands for resting, feeding, wintering, or migratory rest-stops. Because of the number of species that nest at GUIs, the Superintendent's Compendium addresses locations closed to all visitors for nesting shorebirds.

Land Mammals. Common native species include raccoons, opossums, skunks, eastern cottontails, marsh rabbits, and gray squirrels. Nonnative or introduced species include nine-banded armadillos, Norway rats, black rats, hispid cotton rats, coyotes, and red foxes. Beavers and river otters are occasionally observed in the canals near Fort Pickens, Santa Rosa beach mice are seen at Santa Rosa Island, and endangered Perdido Key beach mice inhabit sand dunes at Perdido Key. Other small rodents include eastern wood rats, eastern moles, southeastern pocket gophers, and short-tailed shrews. Gray foxes are one of the few carnivorous animals at the Seashore. Horn and Petit Bois Islands have populations of river otters and introduced nutria. Davis Bayou, where the vegetation is more diverse, has additional upland animals, including opossum, squirrel, armadillo, gray fox, bats, and river otters.

Marine Mammals. Atlantic bottle-nosed dolphins are a common sight in the Gulf of Mexico. Rare marine mammals include manatees and small whales. There are 29 marine mammals in the Gulf of Mexico.

Fish. The waters off GUIs provide habitat for numerous species of fish. More than 200 species of fish have been observed in waters around and on the barrier islands. The most abundant fish are anchovies. Silversides are abundant in the shallow near-shore waters. Speckled sea trout spawn around the islands and are probably the most sought after sportfish. The channel bass, sand

sea trout, kingfish, jack, flounder, mackerel, bluefish, pompano, snapper, and many other species provide excellent surf and troll fishing. Cobia, locally known as lemon fish, and tarpon are among the large game fish. Mullet are abundant and are taken by cast nets. The scrawled cowfish, puffer, and striped burrfish are interesting and unusual fish species.

Several species of sharks live in these waters, including hammerhead, bonnethead, Atlantic sharpnose, bull, and blacktip. Stingrays rest and feed on the bottom. Southern stingrays are the most abundant, particularly in shallows; manta may be seen and spotted eagle rays occasionally jump clear out of the water.

Reptiles. Alligators, lizards, snakes, turtles, and frogs are found at GUIS. Four species of sea turtles, loggerheads, green, Kemp's Ridley, and leatherbacks have been sighted at GUIS, and all are classified as threatened or endangered species. In addition to the sea turtles, documented land turtles include snapping, Florida cooter, box, yellow-bellied sliders, and the endangered gopher-tortoise. There are 18 species of snakes recorded, of this number four are poisonous: coral snake, diamondback rattle snake, cottonmouth snake, and pigmy rattlesnake. Nonpoisonous snakes documented at the Naval Live Oaks Area are black racer, corn snake, hognose snake, coachwhip snake, yellow-bellied water snake, banded water snake, Florida green water snake, brown water snake, rough green snake, red-bellied snake, crowned snake, and garter snake. The only snakes recorded at the Fort Pickens Area are the cottonmouth snake, scarlet snake, black racers, diamondback rattlesnake, coachwhip snake, banded water snake, and ribbon snake. Lizards and skinks are easily spotted, and most are seen at the Naval Live Oaks Area. Green anoles can change colors to blend in with their surroundings. Others include fence lizards, race runners, board-headed skinks, ground skinks, mole skinks, and the unusual eastern glass lizard that looks like a snake.

Amphibians. The most recognized amphibians are frogs and toads, including the cricket frog, oak toad, southern toad, narrow-mouth frog, green tree frog, pine wood treefrog, barking treefrog, squirrel treefrog, ornate chorus frog, pig frog, and leopard frog. However, other amphibians, such as the red newt, two-toed amphiuma, and slimy salamander, live here.

Invertebrates. The blue crab, fiddler crab, and lined hermit crab are often seen on the beaches and in the marshes. The bays are home to shrimp, eastern oysters, octopus, and clams.

Hydroids, jellyfish, and sea anemones are a part of the seashore fauna. Native snails include oyster drill, moon shell, and several species of olive shells. The small bivalve coquina clam lives at the swash line in large concentrations. Cockle shells, the largest bivalve mollusks, are commonly washed ashore on all of the islands. A few oysters grow in ponds and lagoons where salinity is low enough to limit predators and disease.

Potential Impact of PWC Use on Wildlife and Wildlife Habitat Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS

Regulation As Previously Managed. According to the GUIS EA, this alternative would cause minor to moderate adverse impacts to aquatic wildlife species and habitats, negligible to minor adverse impacts to terrestrial mammals within the national seashore, minor to moderate adverse impacts to avian species, and moderate to possibly major adverse impacts to aquatic fauna. On a cumulative basis, this alternative would cause minor to moderate adverse impacts to aquatic wildlife species and habitats, minor to moderate impacts to avian species, negligible to minor impacts to terrestrial mammals, and moderate to major impacts to aquatic fauna from PWC and other motorized vessel noise. An increase in impacts in 2012 is possible. NPS concludes that Alternative A would not result in an impairment of wildlife or wildlife habitat.

Alternative B—Reinstate PWC Use Under A Special NPS

Regulation With Additional Management Prescriptions. According to the GUIS EA, this alternative would have minor to moderate adverse impacts to aquatic wildlife species and habitats, negligible adverse impacts to terrestrial mammals, negligible to minor adverse impacts to avian species with primary habitat located in shoreline areas, and minor to moderate impacts on aquatic fauna. Flat-wake zoning prescriptions would minimize impacts to shoreline wildlife. On a cumulative basis, this alternative would have minor to moderate impacts to aquatic and avian species and negligible to minor impacts to terrestrial wildlife and habitat. NPS concludes that

Alternative B would not result in an impairment of wildlife or wildlife habitat.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to wildlife or wildlife habitat from PWC would occur within GUIs if the ban continued.

Current Conditions for Threatened, Endangered, and Special Concern Species

Piping plovers (threatened species on its wintering grounds) use both the Florida and Mississippi Districts of GUIs to overwinter. GUIs lands are designated as critical habitat for these overwintering activities concentrated on the open beaches and tidal flats. Four species of threatened and endangered sea turtles frequent park waters and nest on park beaches. All feed and loaf just offshore, and the loggerhead and green sea turtles are known to frequent seagrass beds in the park's estuarine areas. Park waters are also used on a regular basis by American alligators (threatened species), Gulf sturgeon (threatened species), and, on a much less regular basis, West Indian manatees (endangered species). Gulf sturgeon have been found to spend much time in the shallow passes between the Mississippi islands. Sturgeon are also known to use Pensacola Pass as they move to and from their river spawning sites.

Current closures related to protected species include nesting shorebirds and eagle/osprey closures, as described in the wildlife section, above. GUIs has also instituted the following relic dune closures as stated in the GUIs EA (NPS, 2003b):

- The area north of Highway 399 through the Santa Rosa area, within 0.5 mile of the paved parking areas, as designated by signs.
- The area north of Ft. Pickens Road, within 0.5 mile of the paved parking areas, as designated by signs.

Baseline Impact of PWC Use on Threatened, Endangered, and Special Concern Species at GUIs

Currently, the PWC ban prevents conflict between PWC and threatened and endangered species.

Potential Impact of PWC Use on Threatened and Endangered Species Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS

Regulation As Previously Managed. According to the GUIS EA, this alternative may affect, but is not likely to adversely affect any federal or state listed or other special status species.

Bald eagles, a federally threatened species, and osprey nest on Horn and Petit Bois Islands in the Mississippi District. Research and park-specific data have shown that human intrusion along the shoreline disturbs these birds, often to the point of nest abandonment.

Osprey have been observed by park staff to repeatedly flush from a nest as a PWC performed “figure eight” maneuvers in adjacent waters. The osprey finally settled back onto the nest once the PWC exited the area (Administrative Determination).

During nesting season, male and female turtles congregate in the shallow Gulf waters just off the beach, the very areas that PWC used prior to the ban. Because PWC shared the same waters, collisions with sea turtles represented a significant threat to the turtle populations.

On a cumulative basis, this alternative is not likely to adversely affect special status species. NPS concludes that Alternative A would not result in an impairment of protected species.

Alternative B—Reinstate PWC Use Under A Special NPS

Regulation With Additional Management Prescriptions. According to the GUIS EA, this alternative may affect, but is not likely to adversely affect any federal or state listed or other special status species. On a cumulative basis, this alternative is not likely to adversely affect special status species. Management prescriptions would minimize impacts. The additional flat-wake zones under Alternative B would result in fewer disturbances of species than Alternative A. NPS concludes that Alternative B would not result in an impairment of protected species.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to protected species from PWC would occur within GUIS if the ban continued.

2.5.6 Shorelines and Shoreline Vegetation

PWC use may adversely affect shoreline habitat, including the shoreline, shoreline vegetation, and submerged aquatic vegetation (SAV) beds. Shoreline and shoreline vegetation provide critical habitat for the juvenile stages of fish, as well as aquatic invertebrates, shellfish, waterfowl, and other fish life stages. SAV beds are also critical to aquatic organisms. SAV beds reduce wave action, support nursery fish, provide protection from predators, stabilize sediment, and provide food for many species.

PWC can affect shoreline and shoreline vegetation because they are able to access areas where most other watercraft cannot go due to their shallow draft. As a result, PWC may land on the shoreline allowing visitors to access and disturb areas where sensitive plant species exist. In addition, wakes created by PWC may cause erosion. Turbulence from boat propellers near the shoreline can also erode the shoreline by destabilizing the bottom (WDNR, 2000).

PWC use can affect SAV by increasing turbidity, which may result in decreased sunlight available for SAV, limit vegetation growth, and ultimately reduce water quality. PWC use in shallow water supporting SAV may reduce its value as important habitat for animals, by redistributing the plants and organisms that use these grasses for habitat.

Baseline Condition of Shorelines and Shoreline Vegetation at GUIS

GUIS has extensive areas of marine grass beds. The seagrass meadows located within GUIS and surrounding waters are vital nursery areas for the Gulf of Mexico. Seventy percent of recreational fisheries in the Gulf are estuarine-dependent; for commercial fisheries, the percentage is even greater. Seagrass communities are one of the most biologically diverse communities in the southeastern U.S. and are in severe decline, mostly because of human causes.

The marine grass bed ecosystem grows throughout the protected seashore waters, where sandy bottoms, shell fragments, and calm waters provide the proper habitat. The seagrasses occur in isolated patches usually less than several hundred acres in size. In the turbid Mississippi Sound waters, the seagrasses are rarely found in water deeper than 6 feet. These communities provide food for the

marine ecosystem, and provide cover for many young fish. Although the grass beds make up only a small percentage of the total submerged lands around GUIs, the fauna observed in association with them, especially the invertebrates, appears far greater than the more extensive sandy areas. The sea grass community is very fragile and easily disturbed by human activity, such as propeller scarring and turbidity increases caused by dredging.

Storm activity, especially hurricanes, can also lead to extensive grass bed destruction. Prior to 1969, an estimated 20,000 acres of grass beds existed in the Mississippi Sound; however, much of this acreage was destroyed by hurricane Camille, and the grass beds have not yet completely reestablished.

Before the passage of Camille through Mississippi Sound, three seagrass species were dominant along the Mississippi offshore islands. These species were shoal grass, manatee grass, and turtle grass. Large expanses (up to several hundred acres in size) of these seagrasses grew in conjunction with red, brown, and green algae. Because of extensive shifting sands and increased water turbulence, large expanses of sea grasses were lost during hurricane Camille, particularly around Ship Island. The grass beds along East and West Ship Island are generally found within 1,500 feet of the shoreline. Grass bed coverage along the sound side of Horn Island was also dramatically reduced by hurricane Camille. However, increased species diversity is found off Horn Island, with occasional patches of manatee and turtle grass. Petit Bois, which was the furthest from hurricane Camille, was least affected. Large expanses of diverse grass beds can still be found off the sound side shore of Petit Bois Island.

Because PWC are currently banned at GUIs, they have no impact on the shoreline or shoreline vegetation.

Potential Impact of PWC Use on Shoreline and Shoreline Vegetation Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS Regulation As Previously Managed. According to the GUIs EA, this alternative would result in minor to moderate adverse impacts, on a PWC specific and cumulative basis, to shoreline vegetation and

seagrass communities, with the potential for increased impacts in 2012. NPS concludes that Alternative A would not result in an impairment of shorelines or shoreline vegetation.

Alternative B—Reinstate PWC Use Under A Special NPS

Regulation With Additional Management Prescriptions. According to the GUIS EA, this alternative would result in negligible adverse impacts to shoreline vegetation from physical disturbance and wave action, minor adverse impacts from visitor access to emergent shoreline vegetation, and minor adverse impacts to seagrass habitats, with the potential for increased impacts in 2012. On a cumulative basis, this alternative would have minor to moderate impacts to shoreline vegetation and submerged aquatic vegetation. NPS concludes that Alternative B would not result in an impairment of shorelines or shoreline vegetation.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to shorelines or shoreline vegetation from PWC would occur within GUIS if the ban continued.

2.5.7 Cultural Resources

GUIS contains numerous cultural resources, including native American archaeological sites, early colonial settlements, and naval fortifications that remained active until World War II. Because PWC are currently banned, there are no impacts to cultural resources from their use.

Potential Impact of PWC Use on Cultural Resources Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special NPS

Regulation As Previously Managed. According to the GUIS EA, this alternative would have minor adverse impacts on listed or potentially listed archeological sites from possible illegal collection and vandalism and would have minor adverse impacts on listed or potentially listed archeological sites as a result of erosion. On a cumulative basis, this alternative would have minor to major adverse impacts, due to the number of visitors and the potential for illegal collection or destruction. NPS concludes that Alternative A would not result in an impairment of cultural resources.

Alternative B—Reinstate PWC Use Under A Special NPS

Regulation With Additional Management Prescriptions. According to the GUIs EA, this alternative would have minor adverse impacts from PWC use with minimized erosion impacts resulting from flat-wake zoning. On a cumulative basis, this alternative would have minor to major and adverse effects on archeological resources that are readily accessible due to the number of visitors and the potential for illegal collection or destruction. NPS concludes that Alternative B would not result in an impairment of cultural resources.

Alternative C—No-Action Alternative—Continue PWC Ban. No impacts to cultural resources from PWC would occur within GUIs if the ban continued.

2.6 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

GUIs is a group of barrier islands in the Gulf of Mexico, located off the coasts of Florida and Mississippi, many of which are accessible only by watercraft. The seashore has four visitor centers: the park headquarters at Naval Live Oaks in Gulf Breeze, Florida; the Fort Pickens Visitor Center on Santa Rosa Island, Florida; the Fort Barrancas Visitor Center at the Naval Air Station in Pensacola, Florida; and the William M. Colmer Visitor Center at Davis Bayou in Ocean Springs, Mississippi. The population centers in the region are concentrated along the coast. Inland lands in the region are more rural, with much of the area made up of marsh and open water. Cities and towns located in the GUIs area include Destin, Fort Walton Beach, Gulf Breeze, Pensacola, and Pensacola Beach, Florida; Gulf Shores, Alabama; and Pascagoula, Ocean Springs, Biloxi, and Gulfport, Mississippi.

Five counties are located adjacent to GUIs: Escambia, Santa Rosa, and Okaloosa Counties, Florida; and Jackson and Harrison Counties, Mississippi. The economies of the nearby areas are very diverse, although tourism is a major activity. For all counties except Jackson County, Mississippi, and Okaloosa County, Florida, retail trade is the largest sector of the economy, followed by manufacturing and wholesale trade. Retail trade is also the largest sector of the economy in Okaloosa County, but wholesale trade is the second largest sector of the economy in this county and manufacturing is the third largest. In Jackson County,

NPS identified four PWC rental shops and 13 PWC sales/service shops located in communities near GUIs.

manufacturing is the largest sector, followed by retail trade and wholesale trade (Census Bureau, 2002). Tourism is an extremely important part of the local economy. However, PWC use in GUIs makes only a small contribution to tourism-related revenues in the regional economy. NPS estimates that PWC users make up approximately 0.1 percent of total visitation.

NPS identified four PWC rental shops and 13 PWC sales/service shops located in communities near GUIs. NPS contacted some of these firms to gather information relevant to this report and to assess the impact the ban of PWC in GUIs has had on their business. Two of these rental shops, both in Pensacola Beach, Florida, indicated that none of their customers use GUIs, and that they had not been affected by the ban on PWC in GUIs. The two other firms renting PWC identified are located in Pensacola Beach and Navarre Beach. NPS was only able to contact the Pensacola Beach firm, which indicated it has experienced only minor impacts as a result of the ban on PWC in GUIs. This firm no longer offers long-term rentals (rentals more than 1 hour) to reduce the possibility that their customers would enter areas of the park that have been closed. The other firm renting PWC in Navarre Beach was assumed to have experienced similar minor impacts. NPS did not identify any firms renting PWC near the Mississippi District of GUIs.

Four firms selling PWC were identified in Fort Walton Beach, Florida; four in Pensacola, Florida; one in Gulf Shores, Alabama; one in Orange Beach, Alabama; one in Pascagoula, Mississippi; and two in Gulfport, Mississippi. Based on comments received from these businesses, prior to the ban, GUIs was a popular destination for PWC use, but most PWC users visited other destinations in the area outside of GUIs as well. PWC are sold year-round with the majority of the sales in the late spring/early summer. Interview data suggest that the PWC dealerships near GUIs have other sources of revenue besides PWC sales. Some of the PWC dealerships sold items such as motorcycles, boats (other than PWC), motor scooters, all-terrain vehicles (ATVs), trailers, generators, and outboard motors. Each PWC dealership contacted implied that their business has been severely affected by the park's decision to ban PWC from GUIs in April 2002. Alternatives A and B are expected to have positive effects on PWC-related revenues, while Alternative C would maintain revenues at baseline levels.

In addition to businesses offering PWC sales and service or rental services, the ban on PWC use in GUIS has presumably affected lodging establishments, restaurants, gas stations, and retail stores in the area. However, because PWC users constitute an extremely small fraction of visitors to the local area and many of them are assumed to continue visiting the area for alternative activities, it is very unlikely that the ban has caused substantial impacts on the region's tourist industry. As for the PWC dealerships and rental establishments, Alternatives A and B are expected to have a positive effect on revenues for local tourism-related businesses, while Alternative C would have no incremental impact on revenue relative to baseline conditions. For a more complete discussion of regional economic impacts, see Section 3. For a discussion of impacts to small businesses, refer to Section 5.

3

Economic Impact Analysis of Alternatives for Managing PWC Use in Gulf Islands National Seashore

Regulations on PWC use in GUIs may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing PWC in the park is expected to increase economic activity in the areas surrounding the park. However, the incremental impacts are very small relative to the size of the local economy.

Historically, PWC use has been a relatively minor recreational activity in GUIs. Prior to the April 23, 2002 ban on PWC use in GUIs, an estimated 0.1 percent of annual visitors used PWC in the park. Thus, although reinstating PWC use in GUIs could have a positive economic impact on the surrounding area, any impact is likely to be small. The primary economic impacts associated with Alternatives A and B are the potential increases in the sales, profits, and employment of PWC sales and rental shops, restaurants, and other businesses that serve PWC users visiting GUIs relative to baseline conditions. The total impact of each alternative will depend in large part on the response of the affected individuals and firms to the ban on PWC use in GUIs. To the extent that affected local retailers were able to provide substitute products and services, they may have been able to reduce the negative impact on their profits associated with the 2002 ban. In addition, some former PWC users may have continued to visit GUIs to participate in other recreational activities. It is also possible that visitation to GUIs by non-PWC users increased following the ban on PWC use if the restrictions made park visitation more enjoyable for this group of people. The more that producers and PWC users made adjustments to mitigate the negative impacts of the ban and non-PWC users

increased their visitation, the smaller the positive economic impacts of allowing PWC to return to GUIs.¹

This section summarizes the incremental regional economic impacts associated with the proposed alternatives for managing PWC use in GUIs. The majority of the economic impacts are expected to be concentrated in the counties surrounding the park.² Thus, projected changes in economic activity are compared to the size of the county economies to place the impacts in perspective.

3.1 SCENARIOS EXAMINED IN THIS REPORT

NPS estimates that PWC users accounted for only about 0.1 percent of annual visitation prior to the ban.

As described in Section 2.2, PWC users accounted for a small fraction of total visitation to GUIs prior to the ban in 2002. NPS estimates that 7,027 visitors used PWC in GUIs in 2001 and 4,598 would have used PWC in the park in 2002 in the absence of the ban. Averaging across these 2 years yields an estimate of average annual visitation of 5,812 PWC users for 2001–2002 in the absence of a ban, accounting for only about 0.1 percent of annual visitation to GUIs. Baseline visitation (i.e., with PWC banned from GUIs) was projected through 2012 using the average annual visitation over the last 5 years, 1998 to 2002, as the starting point. NPS assumed that the proportion of visitors who used PWC in 2001 and would have used 2002 was representative of the 1998 to 2002 time period. Baseline visitation was then assumed to increase at a rate equal to the average of the 1990 to 2000 annual population growth rates in counties surrounding the park.³

PWC users are expected to change their visitation to GUIs in response to regulations placed on PWC use. To estimate the magnitude of the resulting economic impacts, NPS constructed scenarios for the regulatory alternatives based on the available information. For

¹A decrease in expenditures for substitute activities in the GUIs region in response to allowing PWC use would partially offset any positive regional impacts associated with Alternatives A and B. In addition, there may be reallocation of revenue among businesses.

²Escambia, Santa Rosa, and Okaloosa Counties, Florida; Jackson and Harrison Counties, Mississippi.

³It would be preferable to use population projections rather than assuming that population growth would continue at historical levels. However, the Census Bureau only provides population projections at the state and national levels. Because most GUIs visitors come from an area covering parts of several states, NPS believes that the recent historical population growth rate in these areas is a more appropriate basis for projecting population than the projected growth rate for the states.

Alternative A, it is expected that PWC users who previously used PWC in the park would return because PWC use would be managed in the same way as before the 2002 ban. Under Alternative B, PWC users would be able to use their PWC in GUIS as previously managed with additional flat wake zones, restrictions on operating PWC near nonmotorized watercraft and people in the water, and prohibitions on the removal of manufacturer installed emissions control equipment from PWC. Thus, it is assumed that most former PWC users, but not all, will return to visit the GUIS region to use PWC. However, of those who do not, some will return to GUIS to enjoy other recreational activities or use PWC in nearby substitute areas. Under Alternative C, it is expected that there will be no change in visitation relative to baseline projections because management of PWC in GUIS would remain unchanged relative to current conditions.

Under Alternatives A and B, it is assumed that people who resume visiting the GUIS area will have the same spending patterns as current visitors, except that some of them will begin renting PWC. It is possible that some visitors who currently engage in summer recreational activities other than PWC use would reallocate spending on those activities towards expenditures on PWC use. However, because there is no specific data available on spending by users engaging in different types of recreation, this potential spending change is not included in the analysis.

To better develop the economic impact scenarios, NPS interviewed PWC sales and rental shop owners identified in the area concerning the expected impacts on those businesses. The universe of affected entities was identified by visiting the GUIS area and contacting potentially affected businesses. In addition, NPS used secondary sources such as *infoUSA* (2002) to help identify businesses in the region that may have revenues related to PWC use in GUIS. NPS identified four PWC rental shops and 13 PWC sales/service shops located in communities near GUIS. However, there may be other firms in the region not identified by NPS that may be directly affected by regulations on PWC use in GUIS. NPS contacted several of the firms identified to gather information relevant to this report and to assess the impacts associated with banning PWC in GUIS. Two of the rental shops identified, both in Pensacola Beach, Florida, indicated that none of their customers use GUIS. Therefore, they have not been affected by the ban on PWC in GUIS and

implementing Alternative A or B presumably would have no impact on their rental businesses. The other rental shop contacted believed that implementing Alternative A or B might result in an increase in its PWC rentals relative to baseline conditions, because it would increase the demand for day-long and half-day PWC rentals. Due to the ban on PWC use in GUIs, this firm has added restrictions on where their renters could travel to prevent them from violating the GUIs ban on PWC use. As a result, their typical PWC rental has become shorter in duration.

Prior to the ban, GUIs was a popular destination for PWC use on the Florida and Mississippi Gulf Coast.⁴ The PWC dealerships contacted believed that restrictions on PWC use in GUIs have caused a sharp reduction in sales. Data collected from these firms showed each experiencing a reduction in unit sales since 2000. Some dealerships reported that, although sales of other products such as ATVs and motorcycles increased in 2002, sales of PWC declined. Most dealerships attributed the decline in PWC sales directly to the ban of PWC in GUIs. However, it should be noted that national PWC sales have been declining since 1996, suggesting that there are other potentially important factors contributing to the recent decline in sales. According to the firms interviewed, the ban had caused losses in PWC-related revenues often greater than 40 percent of total PWC revenues. In fact, some firms suggested that if the ban continues, they may close their business as a result of the loss in revenues related to PWC.

NPS used information from these interviews to help estimate baseline revenues for firms deriving revenue from PWC use in GUIs. In some cases, NPS used estimates of business revenues from *infoUSA*. However, these data are only provided in ranges. NPS used the midpoint of this range for the analysis, which may understate or overstate the actual revenue of a particular business.

Based on information collected from local businesses and GUIs park staff, scenarios were developed for each of the proposed regulatory alternatives. The three primary scenarios analyzed for GUIs are summarized in Table 3-1. For Alternatives A and B, NPS

⁴While only a very small share of GUIs visitors are PWC users (about 0.1 percent), the park is one of the most popular destinations in the area for PWC use according to local PWC dealerships.

Table 3-1. Assumptions Used in Analyzing Economic Impacts of GUIS Regulatory Alternatives (%)

	Alternative A	Alternative B	Alternative C
Annual percentage change in the number of visitors using PWC in GUIS that would have occurred in the absence of the ban ^a	9.59%	9.59%	9.59%
Baseline annual percentage change in non-PWC user visitation to GUIS ^b	1.63%	1.63%	1.63%
Percentage of visitors reducing PWC use in GUIS due to ban that will continue to visit for other activities ^c	50%	50%	50%
Percentage of visitors using PWC in GUIS prior to ban that will resume using PWC in GUIS if PWC use is authorized ^c	100%	95%	NA
Percentage of visitors renting PWC for use in GUIS prior to ban that will resume renting PWC for use in GUIS ^c	100%	95%	NA
Percentage of visitors purchasing PWC in the GUIS region prior to the ban who will continue to purchase PWC in the GUIS region ^c	100%	95%	25% ^d

NA = not applicable

^aBased on annual percentage change in PWC registrations in Escambia, Okaloosa and Santa Rosa Counties, Florida (Florida Fish and Wildlife Commission, 2003).

^bBased on regional population growth from 1990 to 2000 (U.S. Census Bureau, 2002).

^cNPS estimates.

^dThis is the percentage of people who are expected to continue purchasing PWC at shops in the FIIS region for use in other areas.

assumed that PWC use would have been increasing at a 9.59 percent annual rate in the absence of the ban based on recent local trends in PWC registrations (see Table 3-2).⁵

For visitors who do not use PWC, visitation to the park was assumed to be increasing at an annual rate equal to the average annual population growth rate over the last decade for the county surrounding GUIS (see Section 2.2.3). That growth rate was 1.63 percent, which is above the national growth rate of 0.9 percent over that time period (Census Bureau, 2002).

⁵This is a very high growth rate for PWC use, but GUIS park staff confirmed that the rate of growth in PWC registrations in local counties was reflective of the rapid growth in use within GUIS prior to the ban based on informal observation. In addition, NPS contacted the Florida Fish and Wildlife Commission to confirm that there was no change in the methodology used for collecting registration data during this period.

Table 3-2. PWC Registration Data

Location	1997	1998	1999	2000	2001	Average Annual Growth
Escambia County	1,187	1,344	1,395	1,744	1,480	5.67%
Okaloosa County	1,970	2,216	2,295	2,557	2,429	5.38%
Santa Rosa County	506	607	738	1,291	1,375	28.39%
Total for 3 Counties	3,663	4,167	4,428	5,592	5,284	9.59%
Florida, Statewide total	70,606	77,416	81,693	105,355	89,442	6.09%

Source: Florida Fish and Wildlife Commission. 2003. "Boating Accident Statistics."
<http://floridaconservation.org/law/boating/>. As accessed March, 2003.

It was assumed that PWC visitation to GUIs would increase to pre-ban levels under Alternative A, increase to 95 percent of pre-ban levels under Alternative B, and remain at baseline levels under Alternative C.

It was assumed that PWC visitation to GUIs would increase to pre-ban levels under Alternative A, increase to 95 percent of pre-ban levels under Alternative B, and remain at baseline levels under Alternative C. Accordingly, PWC sales and rental revenues are both assumed to return to pre-ban levels under Alternative A and 95 percent of pre-ban levels under Alternative B. Under Alternative C, it is expected that there will be no change in PWC sales or rental revenues relative to baseline projections because PWC would continue to be banned in GUIs. It should be noted that, under the baseline projections, which assume PWC are banned from GUIs, PWC rentals are assumed to have declined by 100 percent relative to pre-ban levels and PWC sales are assumed to have declined by 75 percent relative to pre-ban levels.⁶

As described in Section 2.2.3, baseline visitation beginning in 2003 was estimated by assuming that those visitors who previously used PWC in GUIs but were forced to stop because of the April 2002 ban would reduce their total visits to GUIs by 50 percent (i.e., they would continue to visit the park to engage in alternative activities, but would visit less often).

⁶Sales are assumed to have declined less than rentals based on interviews with local businesses.

Between 1998 and 2001, national PWC ownership fell by an average of 1.45 percent annually.

To project PWC use from 2003 through 2012 for the alternatives where PWC would be permitted in the park (Alternatives A and B), NPS used data on local PWC registration trends. As shown in Table 3-2, PWC registrations in Escambia, Okaloosa and Santa Rosa Counties have been increasing rapidly in recent years. Between 1997 and 2001, PWC registrations rose by an average of 9.59 percent annually in these three counties (Florida Fish and Wildlife Commission, 2003). This rapid increase in the GUIs region is in contrast to national data, which show a significant decline in sales in recent years. As shown in Table 3-3, sales of new PWC have been declining dramatically since 1995 (NMMA, 2002). However, it is certainly possible that regional PWC use differs from national trends, especially for coastal areas with many alternative areas for PWC use. Local data on PWC use along the Gulf Coast were judged to be reasonable by NPS staff at GUIs based on informal observations of the rapid growth in PWC use in GUIs. Based on input from park staff, NPS assumed that the growth rate of PWC registrations in Escambia, Okaloosa, and Santa Rosa Counties was representative for the growth in PWC use in the entire park (NPS, 2003a).

Table 3-3. National PWC Sales, 1991–2001 (Number of PWC)

Year	PWC Sales
1991	68,000
1992	79,000
1993	107,000
1994	142,000
1995	200,000
1996	191,000
1997	176,000
1998	130,000
1999	106,000
2000	92,000
2001	83,000

Source: National Marine Manufacturers Association (NMMA). 2002. "Annual Retail Unit sales Estimates." *Boating 2001*. National Marine Manufacturers Association. <www.nmma.org>. As obtained July 11, 2002.

Table 3-4 presents the projected incremental visitation associated with the alternatives for PWC management in GUIS using the assumptions summarized in Table 3-1. Alternatives A and B both increase total visitation because they eliminate the ban on PWC use in GUIS, leading to a net increase in visitation by people who used PWC in GUIS prior to the April 2002 ban.⁷ The increase in PWC users in the park shown in Table 3-4 reflects those visitors that used PWC in GUIS prior to the ban that resume PWC use under Alternatives A and B. The decrease in non-PWC visitation by former PWC users under these alternatives reflects those former PWC users that had continued to visit the park to engage in alternative activities, but will now resume PWC use instead. There is no change in visitation relative to baseline conditions expected under Alternative C because this alternative maintains the ban on PWC use in GUIS.

3.2 IMPACT OF PWC REGULATIONS ON LOCAL ECONOMIES

Generally, allowing the use of PWC in GUIS is expected to increase economic activity slightly in the areas surrounding the park.

The proposed regulations may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing the use of PWC in GUIS is expected to increase economic activity slightly in the areas surrounding the park relative to baseline conditions. The following sections describe the estimated economic impacts on the region where the majority of the effects from increased visitation to GUIS will be felt.

3.2.1 Effect of Regulation on Visitation to GUIS Area

Alternatives A and B are expected to lead to an increase in the number of visitor-days spent in GUIS compared with the projected baseline, as shown in Table 3-4.⁸ This anticipated increase in the number of visitor-days is primarily due to the expectation that some people who used PWC in the park prior to the ban will increase their visitation to GUIS relative to the baseline if PWC use is

⁷It is possible that there would also be a reduction in visitation by non-PWC users who were not former PWC users if PWC use were reauthorized. However, the impact of this possible reduction has not been quantified because of a lack of data.

⁸This analysis was performed prior to the 2003 season. However, impacts are expected to be very similar over the 10 years following implementation to those presented in this report.

Table 3-4. Incremental GUIS Visitation Under Regulation Relative to Baseline Conditions^a

Year	Alternative A			Alternative B			Alternative C ^b		
	Former PWC Users that Resume PWC Use ^c	Non-PWC Users ^d	Total Visitation	Former PWC Users that Resume PWC Use ^c	Non-PWC Users ^d	Total Visitation	Former PWC Users that Resume PWC Use ^c	Non-PWC Users ^d	Total Visitation
2003	6,318	-3,159	3,159	6,002	-3,159	2,843	—	—	—
2004	6,924	-3,159	3,765	6,578	-3,159	3,419	—	—	—
2005	7,588	-3,159	4,429	7,209	-3,159	4,050	—	—	—
2006	8,316	-3,159	5,157	7,900	-3,159	4,741	—	—	—
2007	9,114	-3,159	5,955	8,658	-3,159	5,499	—	—	—
2008	9,988	-3,159	6,829	9,489	-3,159	6,330	—	—	—
2009	10,946	-3,159	7,787	10,399	-3,159	7,240	—	—	—
2010	11,996	-3,159	8,837	11,396	-3,159	8,237	—	—	—
2011	13,147	-3,159	9,988	12,489	-3,159	9,331	—	—	—
2012	14,408	-3,159	11,249	13,687	-3,159	10,529	—	—	—

^aNPS generated these estimates using the assumptions in Table 3-1.

^bNPS assumed that there would be no change in visitation relative to baseline conditions under Alternative C because this alternative maintains baseline PWC management (ban on PWC use in GUIS).

^cThis column includes those visitors that used PWC in the park prior to the April 2002 ban who would resume use if PWC use were reinstated. It includes both former PWC users that were assumed to visit the park for other activities during the ban (who are recategorized from non-PWC users to PWC users in this table) and former PWC users that were assumed to stop visiting the park if they cannot use PWC (their return to visiting the park leads to a net increase in visitation relative to baseline for Alternatives A and B).

^dThese are the former PWC users who were assumed to continue to visit the park to engage in alternative activities under baseline conditions. If PWC use is authorized, these visitors are expected to resume using PWC in the park and are counted as PWC users rather than non-PWC users in the table.

reinstated. The actual increase in park visitation depends on several factors. Some people who previously used PWC in GUIs may have chosen to continue visiting the park after the ban on PWC use to enjoy alternative summer activities available within GUIs, such as swimming, hiking, boating, and fishing. As mentioned earlier, visitation by non-PWC users may have increased as a result of the ban on PWC use because the absence of PWC may have created a more enjoyable outdoor experience for some members of this group. This increased visitation could partially offset the loss in PWC users but was not quantified in this report because of a lack of data. Consequently, to the extent that non-PWC users increased their visitation to the park as a result of the ban on PWC use, the results of this analysis may have overestimated the change in visitation resulting from regulations that allow PWC to return to GUIs.

3.2.2 Effect of Regulation on Local Business Output

As a result of the incremental increases in visitation to the GUIs area expected under Alternatives A and B, there will be a corresponding increase in the value of local business output. The primary sectors that are affected by an increase in summer visitation are the tourism sectors, including PWC sales and rental shops, restaurants, and retailers. As discussed in Appendix A, although the direct impact of an increase in visitor spending is primarily felt in these sectors, many additional sectors of the economy will be affected to some extent through secondary impacts. NPS focuses on the impacts for 2003, the first year after implementation of the selected alternative for PWC management. Impacts in subsequent years will be similar, although they are expected to become larger over time as a result of the projected increase in incremental visitation after 2003 (see Table 3-4). The impact in all years is expected to be very small relative to the size of the local economy.

To estimate spending impacts, it is necessary to obtain spending information for use with this study's estimated changes in visitation. No secondary data are available concerning the reduction in the number of PWC rented, sold, and serviced annually that resulted from the April 2002 ban on PWC in GUIs. Thus, NPS used information provided by local businesses on pre-ban PWC-related revenues and the estimated reductions in PWC sales and rentals that resulted from the ban to project the total increase in revenue for

NPS used information from local businesses on the reduction in revenues that resulted from the April 2002 ban on PWC use in GUIs to estimate the increase in revenues that would occur under Alternatives A and B.

these categories that would occur under Alternatives A and B, which allow PWC to return to GUIS (i.e., assuming that PWC-related revenues would approach or reach pre-ban levels).

For categories of tourism spending other than direct spending on PWC, spending profiles were used in conjunction with estimated changes in visitation to determine the total change in park-related expenditures. The Money Generation Model (MGM2), which is often used by NPS to estimate local economic impacts associated with national park visitation, provides generic spending profiles for national parks.⁹

NPS does not have detailed data on the specific types of visitors using GUIS. Absent this data, NPS assumed that about 25 percent of visitors are local day users, 25 percent are nonlocal day users, 20 percent are campers, 20 percent are nonlocal visitors staying in hotels, and 10 percent are visiting friends and relatives. Table 3-5 provides the spending information available from MGM2 for these five visitor-type categories to show the range of spending values estimated within this category. Only categories with positive average expenditures for a given visitor category are included in the table under that category. For this analysis, the medium estimate was used for all of the spending categories analyzed.¹⁰ Because there is no spending category included that represents boat rentals, purchases, or service, it was assumed that the spending estimates from MGM2 are in addition to spending on PWC rentals, sales, and service related to GUIS.

The MGM2 model assumes different party sizes, average lengths of stay, and number of entries into the park for the various visitor groups based on data gathered from several national parks (e.g., visitors staying in a hotel inside a national park are assumed to have an average party size of 2.5, to stay for an average of 3 days, and to make two entries into the park during their stay).¹¹ The spending profile estimates in Table 3-5 were used in conjunction with the

⁹See Appendix A and the MGM2 website <<http://www.msu.edu/user/stynes/npsmgm/>> for more information about economic impact analysis using input-output [I-O] models.

¹⁰MGM2 provides spending estimates that they classify as low, medium, and high expenditures.

¹¹The model adjusts for multiple entries into the park to avoid counting expenditures for a single party more than once.

Table 3-5. Generic Spending Profiles for Visitors on Day Trips to National Parks (2001\$)^a

	Spending per Party		
	Low	Medium	High
<i>Local Day User</i>			
Restaurants and bars	\$8.64	\$12.35	\$16.05
Groceries/take-out	\$4.33	\$6.19	\$8.04
Gas and oil	\$3.37	\$4.82	\$6.27
Other vehicle expenses	\$0.36	\$0.52	\$0.67
Admissions and fees	\$2.94	\$4.21	\$5.47
Clothing	\$0.69	\$0.98	\$1.28
Sporting goods	\$0.70	\$1.00	\$1.29
Souvenirs and other expenses	\$4.68	\$6.68	\$8.69
Total	\$25.72	\$36.74	\$47.76
<i>Nonlocal Day User</i>			
Restaurants and bars	\$11.52	\$16.46	\$21.40
Groceries/take-out	\$4.33	\$6.19	\$8.04
Gas and oil	\$6.75	\$9.64	\$12.53
Other vehicle expenses	\$0.54	\$0.78	\$1.01
Local Transportation	\$0.18	\$0.26	\$0.33
Admissions and fees	\$5.15	\$7.36	\$9.57
Clothing	\$1.38	\$1.96	\$2.55
Sporting goods	\$0.70	\$1.00	\$1.29
Souvenirs and other expenses	\$6.48	\$9.26	\$12.03
Total	\$37.03	\$52.90	\$68.77
<i>Camping Inside the Park</i>			
Camping Fees	\$11.27	\$16.09	\$20.92
Restaurants and bars	\$7.20	\$10.29	\$13.38
Groceries/take-out	\$9.38	\$13.40	\$17.42
Gas and oil	\$7.42	\$10.61	\$13.79
Other vehicle expenses	\$0.54	\$0.78	\$1.01
Local Transportation	\$0.18	\$0.26	\$0.33
Admissions and fees	\$4.42	\$6.31	\$8.20
Clothing	\$2.06	\$2.95	\$3.83
Sporting goods	\$0.70	\$1.00	\$1.29
Souvenirs and other expenses	\$4.32	\$6.17	\$8.02
Total	\$47.49	\$67.85	\$88.20

(continued)

Table 3-5. Generic Spending Profiles for Visitors on Day Trips to National Parks (2001\$)^a (continued)

	Spending per Party		
	Low	Medium	High
<i>Motel Outside the Park</i>			
Motel, hotel cabin or B&B	\$56.33	\$80.47	\$104.61
Restaurants and bars	\$27.37	\$39.10	\$50.83
Groceries/take-out	\$7.22	\$10.31	\$13.40
Gas and oil	\$6.07	\$8.68	\$11.28
Other vehicle expenses	\$1.09	\$1.55	\$2.02
Local Transportation	\$0.36	\$0.51	\$0.67
Admissions and fees	\$8.83	\$12.62	\$16.41
Clothing	\$4.13	\$5.89	\$7.66
Sporting goods	\$0.70	\$1.00	\$1.29
Souvenirs and other expenses	\$8.64	\$12.34	\$16.04
Total	\$120.73	\$172.48	\$224.22
<i>Visiting Friends and Relatives</i>			
Restaurants and bars	\$8.64	\$12.35	\$16.05
Groceries/take-out	\$8.66	\$12.37	\$16.08
Gas and oil	\$6.07	\$8.68	\$11.28
Other vehicle expenses	\$0.54	\$0.78	\$1.01
Local Transportation	\$0.18	\$0.26	\$0.03
Admissions and fees	\$3.68	\$5.26	\$6.84
Clothing	\$2.06	\$2.95	\$3.83
Sporting goods	\$1.39	\$1.99	\$2.59
Souvenirs and other expenses	\$7.92	\$11.31	\$14.71
Total	\$39.16	\$55.94	\$72.72

^aThese values are based on the average expenditures per party for visitors to national parks. However, the number of people per party assumed by MGM2 may differ between visitor segments.

Source: Money Generation Model—Version 2 (MGM2). 2002. <<http://www.msu.edu/user/stynes/npsmgm/>>. As obtained July 2002.

estimates of visitation changes presented in Table 3-4 to calculate the direct impacts of each alternative on business revenues presented in Table 3-6.¹²

Table 3-6. First-Year Direct Impact of PWC Regulations on Business Revenues in GUIS Region Relative to Baseline (2001\$)^{a,b}

	Alternative A	Alternative B	Alternative C ^c
PWC rentals	\$365,720	\$347,440	\$0
PWC sales/service	\$6,295,370	\$5,875,680	\$0
Motel, hotel, cabin, or B&B	\$8,470	\$7,630	\$0
Camping fees	\$1,690	\$1,530	\$0
Restaurants and bars	\$15,170	\$13,650	\$0
Groceries/take-out	\$7,270	\$6,550	\$0
Gas and oil	\$7,210	\$6,490	\$0
Other vehicle expenses	\$710	\$640	\$0
Local transportation	\$180	\$160	\$0
Admissions and fees	\$6,020	\$5,410	\$0
Clothing	\$2,070	\$1,860	\$0
Sporting goods	\$980	\$880	\$0
Souvenirs and other retail	\$7,780	\$7,000	\$0
Total	\$6,718,640	\$6,274,920	\$0

^aAll impacts were rounded to the nearest \$10. Columns may not sum to totals due to rounding.

^bNPS generated these estimates using the MGM2 model (MGM2, 2002).

^cNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

In the first year for Alternative A, PWC rental revenue is estimated to increase by \$365,720 relative to the baseline estimate, while PWC sales and service revenue is expected to increase by \$6,295,370 (Table 3-6). Under Alternative B, NPS estimated that PWC rental revenue and PWC sales and service revenue would increase by \$347,440 and \$5,875,680, respectively, relative to the baseline.¹³

¹²Because MGM2 uses different assumptions for group size and multiple entries for each user category, it is not possible to use a constant party size and multiply the spending per party estimates presented in Table 3-5 by the expected changes in visitation in Table 3-4 to get the revenue impacts presented in Table 3-6.

¹³Estimated impacts on PWC rentals, sales, and service were derived from interview data collected from local firms.

Alternative C is expected to have no incremental impact on business revenue because it maintains baseline conditions.

For the other spending categories (those that are included in MGM2), the total change in expenditures was calculated by multiplying the change in number of parties of each type (i.e., local day users and nonlocal day users) by the average expenditure per party for that type of visitor for each expenditure category.

As shown in Table 3-6, the largest direct impact is on establishments offering PWC sales and/or service, which account for about 94 percent of the total estimated revenue increases resulting from allowing PWC to return to GUIs. The increase in PWC sales and service revenue is followed by PWC rentals; restaurants and bars; motel, hotel, cabin, and B&B establishments; souvenirs and other retail; groceries/take-out; gas and oil; admissions and fees; clothing; camping fees; sporting goods; other vehicle expenses; and local transportation.

Note that the estimated increases in revenue in Table 3-6 overstate the true direct impact to the region because part of the sales value in the groceries/take-out, gas and oil, clothing, sporting goods, and souvenirs/retail categories goes to individuals and firms outside of the region and thus cannot be considered a gain to the GUI region. Using these changes in revenues as inputs into MGM2, NPS estimated the total regional impacts on output. As discussed in Appendix A, for the retail sector only the retail markup can be included as an increase in regional output for the local area. This explains why the direct effect on the region estimated by MGM2 (reported in Table 3-7) is smaller than the change in revenues provided as input. In particular, because the majority of the revenue reductions occur in PWC sales and only the change of the retail markup is considered to impact regional output, the change in regional output is less than the change in revenue.

In addition to the direct effect of the regulation on the regional economy, the indirect and induced effects (ripple effects on input suppliers and from changes in household income, respectively) are estimated (see Appendix A). The multipliers used for this analysis are those provided in MGM2 for a typical small metropolitan area. Table 3-7 summarizes the first-year total impacts on the value of

Table 3-7. First-Year Total Impacts on Value of Output for GUI Region (2001\$)^{a,b}

	Alternative A	Alternative B	Alternative C ^c
Direct effect	\$3,035,150	\$2,837,410	\$0
Total impact	\$4,223,880	\$3,948,890	\$0

^aAll impacts were rounded to the nearest \$10.

^bNPS generated these estimates using the MGM2 model (MGM2, 2002).

^cNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

The impacts of PWC regulation in GUI on regional output are estimated to be approximately 0.02 percent of local personal income under the alternative with the most positive impact.

output for businesses in the GUI region. In this case, the multiplier effects are moderate. The total impact is about 39 percent larger than the direct effect for both alternatives. The total impact estimated for the three alternatives varies from \$0 to \$4.22 million, depending on the alternative chosen for managing PWC use. The level of personal income in the five counties surrounding the park¹⁴ was about \$22.6 billion in 2001 (BEA, 2003). Thus, the impact on regional output of allowing PWC use in GUI is estimated to be approximately 0.02 percent of local personal income under the alternative with the most positive impact (Alternative A).

3.2.3 Change in Value Added

Another measure of the impact on the local economy is the change in value added due to the regulation. Value added is the dollar value contributed to a product at each stage of its production. It is calculated at each stage by subtracting the costs of intermediate goods from the value of the final good to avoid double-counting the value of intermediate goods. It will be a smaller value than output because it excludes the value of intermediate goods, whereas output measures do not exclude all intermediate goods. The output measure only excludes the cost of goods produced in other regions resold by wholesalers or retailers. To calculate these values for GUI, the MGM2 data for value added as a share of total output in each sector were applied to the estimated changes in local output presented in Table 3-8 to get the direct effect on value added by sector. The MGM2 multiplier for value added in each sector was then applied to estimate the total impact. Table 3-8 provides the total change in value added for the local region as a result of the proposed regulations.

¹⁴Escambia, Santa Rosa, and Okaloosa Counties, Florida; Jackson and Harrison counties, Mississippi.

Table 3-8. First-Year Total Impacts on Value Added for GUI Region (2001\$)^{a,b}

	Alternative A	Alternative B	Alternative C ^c
Direct effect	\$1,504,450	\$1,406,430	\$0
Total impact	\$3,023,090	\$2,826,030	\$0

^aAll impacts were rounded to the nearest \$10.

^bNPS generated these estimates using the MGM2 model (MGM2, 2002).

^cNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

3.2.4 Effect on Personal Income

Personal income is a portion of value added that policy makers are commonly interested in. It comprises employee compensation and proprietor income. Table 3-9 shows how labor income in the GUI region changes as a result of the proposed PWC regulations. This value is smaller than value added because it includes only a subset of the components of value added, but it is often useful to break value added down in this way to estimate the effect on regional personal income. Similar to value added, the direct effect of this component is calculated using the MGM2 data for personal income as a share of output in each sector. The total effect is then calculated by multiplying the direct effect by the personal income multiplier included in MGM2 for each sector.

Table 3-9. First-Year Total Impacts on Personal Income for GUI Region (2001\$)^{a,b}

	Alternative A	Alternative B	Alternative C ^c
Direct effect	\$989,970	\$925,480	\$0
Total impact	\$1,925,220	\$1,800,530	\$0

^aAll impacts were rounded to the nearest \$10.

^bNPS generated these estimates using the MGM2 model (MGM2, 2002).

^cNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

3.2.5 Change in Employment

Another potential effect of the alternatives for PWC use in GUI is to increase employment in the sectors affected by the rules. These changes are calculated by MGM2 based on ratios of sales to employment for the affected industries in the GUI area. As a result of the increase in sales anticipated under this regulation, companies may need more employees. The estimated increase in employment

ranges from 0 to 104 employees. These values are calculated based on MGM2 data on the number of employees per million dollars of output in each industry. Estimated changes in the number of employees are therefore equal to the change in output times the number of employees required per unit of output. Table 3-10 summarizes the results of the employment analysis.

Table 3-10. First-Year Total Change in Employment for GUI Region (number of jobs)^a

	Alternative A	Alternative B	Alternative C ^b
Direct effect	85.1	79.6	—
Total impact	104.0	97.3	—

^aNPS generated these estimates using the MGM2 model (MGM2, 2002).

^bNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

3.2.6 Change in Tax Revenue

In addition to impacts on the local businesses operating near GUI, there is also an impact on the state and local governments.

Mississippi has a 4 percent income tax rate, while Florida does not levy income taxes. NPS assumed an average state income tax rate of 2 percent for the analysis. Neither of the states have local income taxes. In addition to state income taxes, both of the states have sales taxes. Florida's sales tax rate is 6 percent, and Mississippi's is 7 percent. NPS assumes an average sales tax rate of 6.5 percent for the analysis. In addition, county governments collect local sales taxes ranging from 0 to 1.5 percent. NPS assumed a 0.33 percent local sales tax rate (the average of local sales tax rates in the two states) for the analysis. State income tax revenues from affected businesses are estimated to increase by between \$0 and \$19,800 in the three scenarios analyzed, as presented in Table 3-11, based on estimated changes in business revenue. State sales tax receipts are predicted to increase by \$0 to \$436,710. Local sales taxes are estimated to increase by \$0 to \$22,400.

Table 3-11. First-Year Change in State and Local Sales Tax Revenue^{a,b}

	Alternative A	Alternative B	Alternative C ^c
State			
Income Tax	\$19,800	\$18,510	\$0
Sales Tax	\$436,710	\$407,870	\$0
Local			
Sales Tax	\$22,400	\$20,920	\$0

^aAll impacts were rounded to the nearest \$10.

^bNPS generated these estimates using the MGM2 model (MGM2, 2002).

^cNPS assumed there would be no impacts under this alternative because it maintains baseline conditions.

3.2.7 Summary

NPS estimates that the total impact of the proposed alternatives for managing PWC use in GUIs on regional output is \$4.22 million, \$3.95 million, and \$0 for Alternatives A, B, and C, respectively. These increases are very small compared to the size of the regional economy, even under Alternative A, the alternative with the largest impacts.

Several different measures of the economic impacts resulting from alternatives for managing PWC use in GUIs are presented in this section. Each measure provides slightly different information about the expected economic effects on the region. Income and value added are generally considered the best measures of economic impacts because sales and job estimates can be misleading. Sales or output measures include spending on inputs purchased outside the region, and job estimates are distorted by part-time and seasonal positions because the data available are on jobs, not on full-time equivalents. In addition, the wage rates across different jobs vary widely across industries (Stynes, 2000). Income and value added measures both avoid these difficulties and concentrate on changes that affect only the GUIs region.

In the analysis presented here, NPS estimates that the total impact of the proposed alternatives for managing PWC use in GUIs on regional output is \$4.22 million, \$3.95 million, and \$0 for Alternatives A, B, and C, respectively, in the first year after implementing the rule (see Table 3-7). These increases are very small compared to the size of the regional economy, even under Alternative A, which has the largest impacts. In 2001, total personal income in the five counties along the Gulf Coast, where GUIs is located, was approximately \$22.6 billion in 2001 dollars (Bureau of Economic Analysis, 2003). Thus, even if all revenues related to PWC use in GUIs were to reappear in the regional economy, the positive impact would be very small (regional output increases by

less than 0.02 percent of personal income), although businesses and communities in the county that rely heavily on PWC users may experience larger localized impacts.

3.2.8 Uncertainty

A number of factors will affect the regional economic impacts associated with the proposed alternatives. Some of the main sources of uncertainty include the following:

Although NPS has provided its best estimate of the regional economic impacts associated with the proposed alternatives, numerous sources of uncertainty may influence the results.

- The projections of PWC use through 2012 in the absence of a ban were based on NPS estimates of what annual PWC use would have been in 2001 and for 2002 in the absence of a ban (see Section 2.2.4 for uncertainties related to this estimate). To the extent that PWC users accounted for an unusually small or large proportion of total visitation during this period, projected visitation by PWC users may be understated or overstated.
- The trends in local population growth may not constitute a good proxy for the future annual change in visitation to GUIS by non-PWC users. It may understate or overstate the actual change in GUIS non-PWC visitation that would occur in future years under baseline conditions. The uncertainties associated with the baseline projections are discussed in further detail in Section 2.2.4.
- The change in PWC visitation that would occur in the absence of the ban is estimated using local data for PWC registrations. This measure is only an approximation for the trend in GUIS PWC use. The growth rate in PWC of 9.59 percent per year assumed for this analysis is much higher than that used in analyses of other national parks. Although it appears to be representative of recent trends in the area, it is possible that using this high growth rate may overstate the positive impacts, particularly for future years, of allowing PWC to return to GUIS. The uncertainties associated with this estimate are discussed in further detail in Section 2.2.
- The proportion of PWC users who would have continued to visit the park under the ban on PWC use is unknown. As a result, the incremental increase in visitation resulting from reinstating PWC use may be higher or lower than calculated in this analysis.
- Non-PWC users may have increased visitation following the ban. To the extent that they would reduce their visitation relative to the baseline if PWC use were reinstated, the positive impacts to local businesses of reinstating PWC use would be partially offset. Because insufficient information regarding this effect was available, this potential impact was not quantified in the analysis, which will tend to overstate the regional impacts.

- EPA regulations phasing in emissions reductions from new PWC over the period from 1996 to 2006 (See Section 2.2.4) are expected to increase the cost of producing PWC over time. The corresponding increase in market price of PWC may lead to a reduction in sales that would reduce PWC use in GUIs in the absence of the ban relative to the projected levels. This would tend to reduce the incremental benefits attributable to NPS regulations reinstating PWC use in future years. However, cost increases due to these regulations are probably captured in the current PWC use figures to some degree because the rule has already required some reduction in emissions.
- Generic spending patterns and multipliers from MGM2 were used to represent economic activity in the GUIs area. To the extent that spending patterns of PWC users in GUIs differ from the generic spending of local and nonlocal day users and/or the generic multipliers for a national park in a small metropolitan area differ from the multipliers for the GUIs region, the impacts may be understated or overstated.
- In addition, the general uncertainties and caveats are associated with the use of I-O models. These factors are described in further detail in Appendix A.

4

Benefit-Cost Analysis of the Alternative Regulations

The purpose of benefit-cost analysis is to evaluate the social welfare implications of an action—in this case the regulation of PWC use in national parks. The impacts of this action, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals.

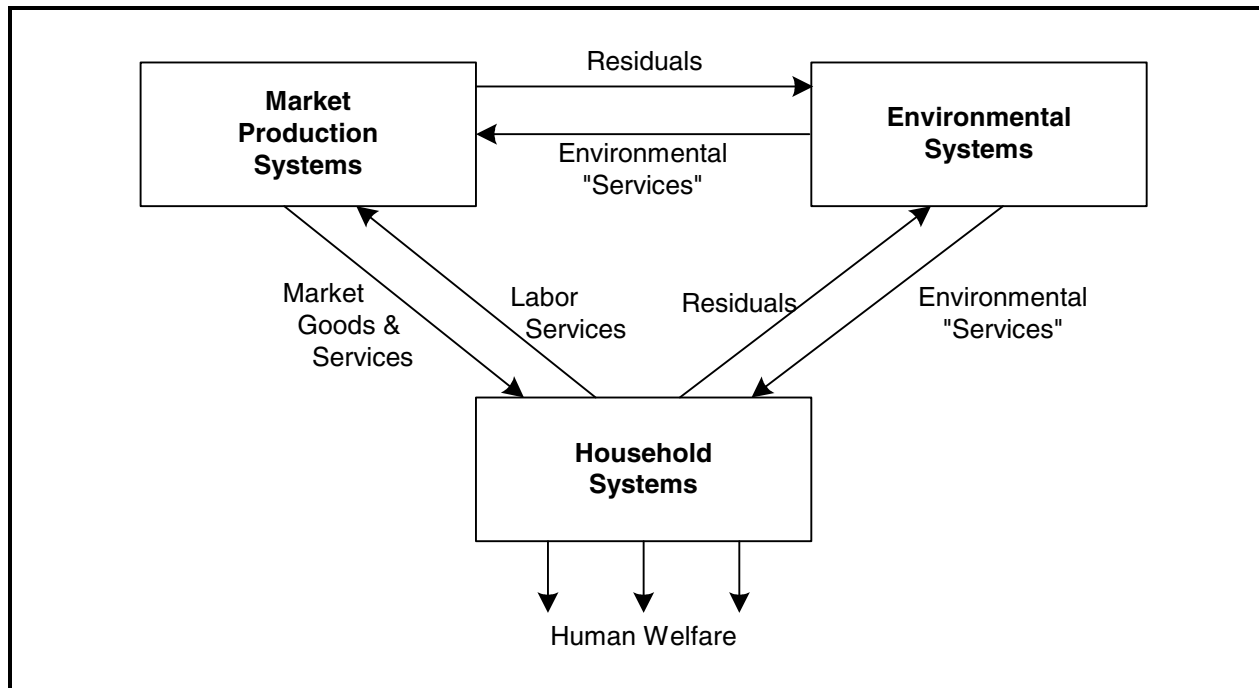
The purpose of benefit-cost analysis is to evaluate the social welfare implications of an action—in this case the management of PWC use in national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action results in benefits (gains in social welfare) greater than the associated costs to society (losses in social welfare).

Section 4.1 provides a general outline of the approach to benefit-cost analysis and the possible benefits and costs of PWC regulations in national parks. Section 4.2 presents the analysis for GUIs specifically.

4.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF PWC RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 4-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment will potentially reverberate throughout all of these systems.

Figure 4-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



Nevertheless, the impacts of regulatory actions, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring benefits and costs must focus on these changes in well-being.

The conceptual framework depicted in Figure 4-1 therefore provides a basis for assessing the benefits and costs of PWC regulations in national parks. In these cases, the most direct impact will be on households that use PWC, whose recreational opportunities will be affected by the regulations. This will result in direct changes in welfare for these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment will be improved or degraded, and this change will change the "services" (primarily recreation-related) that the park provides to other households and individuals in society. Businesses that cater to non-PWC visitors may also be affected if the number of people visiting the park changes. On the other hand, the resulting change in the market demand for PWC-related goods and services

will have impacts for those who own or work for establishments supplying these services.

These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis. Specifically, in Section 4.2 NPS estimates the incremental benefits and costs relative to the baseline.

In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. In other instances, welfare changes are not directly associated with pecuniary gains or losses.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare gains to PWC sales shops due to changes in demand for their services can be reasonably measured as their resulting net change in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such “nonmarket” changes might include, for example, the welfare gains or losses from improved or degraded recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals’ welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such, it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section and Appendix B provide a more detailed discussion of:

- the types of benefits and costs associated with PWC regulations in national parks, and
- the approaches used in measuring these benefits and costs.

4.1.1 Social Costs of PWC Use

Use of PWC in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks’

The private cost of using a PWC is lower than the social cost of PWC use. Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

environmental systems. The negative impacts of PWC use on other people are also referred to as negative externalities. If PWC generate negative externalities, then this represents a market failure. The private cost of using a PWC (the cost to the individual PWC user) will be lower than the social cost of PWC use (where the social cost of PWC use includes both the cost to the PWC user plus the costs to others that result from the negative externalities associated with PWC use). Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

The costs of allowing PWC in national parks can therefore be thought of and measured as the increase in these incremental losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the incremental costs of PWC regulations allowing PWC use must also include increases in these nonenvironmental losses.

Table 4-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with PWC use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential costs associated with PWC regulations in national parks in general. In Section 4.2.3, this framework is then used to specifically describe the costs that are expected to result from the proposed management alternatives for GUIs.

Table 4-1. Classification of Potential Negative Impacts from PWC Use in National Parks

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

Environmental Costs of PWC Use

The use of PWC may have adverse impacts on air quality; natural resources (e.g., water quality, habitat); wildlife; and natural quiet. Figure 4-2 depicts the various categories of potential adverse effects to the environment through which PWC use in national parks can impose welfare losses on society.

- Typical (two-stroke) PWC release substantial amounts of noise and pollutants into the environment. Noise from PWC impairs the natural soundscape for park visitors and has the potential to negatively affect wildlife in the park. Emissions from PWC can also negatively affect park ecosystems, human health, and visitor experiences. The three primary reasons for the potential impacts due to release of pollutants are:
 - ✓ up to one-third of the fuel delivered to the engine is expelled without being burned,
 - ✓ lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
 - ✓ the combustion process results in high emissions of air and water pollutants.

Pollutants are directly released to air and water, causing contamination of air and water resources.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In areas where there are numerous areas available for recreational activities, the value of changing environmental conditions in one of those areas will tend to be smaller.

As shown in Figure 4-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately lose from actions to allow PWC will be individuals who value the quality of the park environment. Many of those that experience losses will be park visitors whose recreational experiences are disturbed. As a point of reference, Table 4-2 reports average consumer surplus values that have been estimated for common non-PWC-related summer recreation activities from a study by Rosenberger and Loomis (2000). These are the types of recreation values that may be diminished by the presence of PWC.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In regions where there are numerous areas available for recreational activities, the value of changing environmental conditions in one of those areas will tend to be smaller. The reason is that there are already many other areas where people can engage in the same activity. Unless there are unique characteristics that people value in the area where

Figure 4-2. Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks

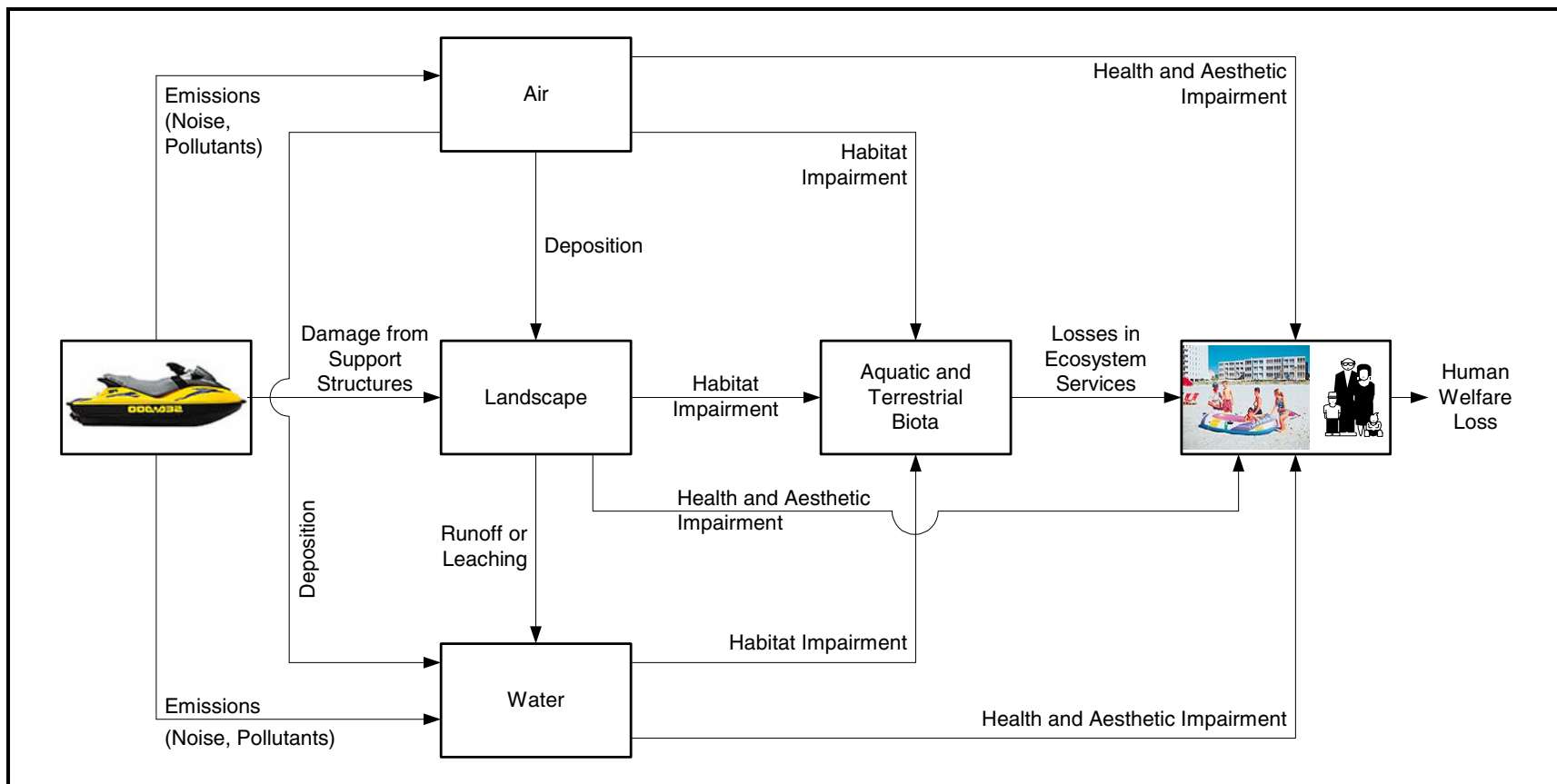


Table 4-2. Summary of Average Recreation Values (2001\$ per Person per Day) for Selected Activities by Region^{a,b}

Activity	Study Location					U.S. Average
	Northeast	Southeast	Mountain	Pacific	National ^c	
Picnicking	59.46 (1)	40.10 (1)	39.10 (7)	79.62 (2)	16.89 (1)	45.78 (12)
Swimming	40.06 (5)	NA	NA	16.10 (1)	22.26 (1)	34.10 (7)
Hiking/backpacking	48.46 (2)	118.40 (2)	40.29 (3)	21.95 (6)	22.47 (1)	43.48 (14)
Fishing	34.06 (42)	29.87 (13)	45.75 (39)	39.96 (16)	40.12 (4)	38.62 (114)
Motor boating	56.46 (2)	NA	74.04 (2)	16.29 (1)	41.67 (1)	53.16 (6)

NA = Not available.

^aAll amounts were inflated using the consumer price index for recreation available from the U.S. Bureau of Labor Statistics (2002). Numbers in parentheses represent the number of observations (i.e., studies).

^bThese values were taken from multiple studies conducted between 1967 and 1998.

^cStudies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

conditions will be improved or degraded, there will probably be relatively small benefits or costs as a result of the environmental change. On the other hand, in regions with few substitutes for the local national park that would potentially experience environmental damage as a result of the regulations, the losses to park users may be much greater.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive or negative "nonuse values" (i.e., a positive WTP) for protecting or degrading the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Pearce and Moran [1994] review studies that have attempted to estimate nonuse values for the protection of unique species and ecosystems. The measurement of nonuse value remains controversial, and in this report NPS does not attempt to quantify the possible benefits or costs associated with nonuse values. Allowing PWC use in national parks can therefore result in losses to both users and nonusers in a number of ways by degrading the parks' ecological resources.

Appendix B provides a detailed discussion of the nonenvironmental impacts, in particular, how these restrictions can affect public safety in national parks and the costs of operating and maintaining the infrastructure necessary to support and monitor PWC use.

4.1.2 Social Benefits of PWC Use

The primary benefits associated with allowing the use of PWC in national parks will accrue to

- PWC users, in particular individuals who have not been able to use PWC in a park as a direct result of restrictions on PWC use, and
- providers of PWC-related services for park visitors.

Just as Section 4.1.1 described potential consumer surplus losses to other park visitors and the public associated with PWC use, the potential welfare gains to PWC users are measured in terms of consumer surplus. Regulations that restrict the use of PWC impose costs on PWC users. For instance, prohibiting PWC use in the park has resulted in a loss of consumer surplus for former GUIS PWC users. Allowing PWC use in GUIS under restrictions such as limiting imposing no-wake zones would increase the consumer surplus of PWC users relative to baseline. A return to pre-ban PWC management practices would increase the consumer surplus of PWC users even further.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip.

As with other activities, the extent of the welfare gain to an individual rider depends crucially on the availability of substitute areas to ride or other activities. All else equal, individuals who have fewer substitutes for PWC use (either other places to use PWC or other activities they enjoy as much) enjoy greater consumer surplus from PWC use in a particular waterbody and thus will experience a greater gain in welfare if the waterbody is opened to PWC use.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. Table 4-2 presents the results of a review of the recreation literature conducted by Rosenberger and Loomis (2000). The review found an average value of \$49.37 (1996 dollars) per person per day for riding in motor boats (with estimates ranging

from \$15 to over \$65). The same study reports a value of \$26.79 (1996 dollars) per person per day (with estimates ranging from \$20 to over \$30) for off-road driving. Bhat et al. (1998) report consumer surplus estimates ranging from \$9.12 to \$54.93 for motorboating and waterskiing in different regions of the country. These estimates, along with the estimates in Table 4-2, provide a range of values for activities similar to riding PWC and provide a bound on the consumer surplus gain for PWC users expected from the proposed regulations. Note that measures of net consumer surplus to PWC riders that do not account for the additional costs imposed on society by the negative externalities associated with PWC use will overstate the true net social welfare associated with the activity.

Even PWC users who do not currently visit the park may have a positive value associated with maintaining access for PWC in parks that they could potentially decide to visit in the future. These users hold an option to visit the park in the future. Restrictions on PWC access to parks would reduce or eliminate the value of that option. Thus, PWC users who do not visit the park may still experience a gain in welfare if the park allows PWC use. However, due to a lack of information concerning the population of PWC users who may potentially choose to visit a given park in the future and the value that they place on that option, NPS does not attempt to quantify the potential gains in option value.

An increase in PWC use at a particular park may also impact businesses that offer services to PWC users. These businesses are not directly affected by NPS regulations of PWC users (i.e., none of the regulations directly require any action from PWC dealerships, rental shops, or other businesses), but are likely to be impacted nonetheless. For example, allowing PWC use in national parks may lead to increased demand for PWC sales or rentals and decreased demand for motorboats or canoes. These shifts in demand may reallocate sales among businesses and may lead to an increase in total revenue for businesses providing tourism-related services. As described in Section 3, there may also be ripple effects on the local economy. If businesses that serve PWC users experience an increase in demand for their services, they will most likely increase their purchases of inputs from other sectors of the local economy, including labor. In addition, an increase in revenue for local firms tends to increase regional income. Increases in average household

income for the region surrounding the park will also lead to increases in sales for local businesses as local households respond by purchasing more goods (see Appendix A for more detailed information on ripple effects).

Whether these indirect, or secondary, impacts should be included as a change in social welfare in the benefit-cost analysis depends on whether the change in demand or supply in the secondary market results in prices changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general, when the policy change in the primary market (PWC trips to a national park) causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. If the people who would have used PWC in the national park spend their money elsewhere instead, this represents a transfer from one region of the country to another or from one business to another. Although the loss in revenue may hurt the businesses located near the national park, from society's point of view this represents a transfer of income rather than a true cost to society as a whole.

Without more detailed information, it is difficult to predict with certainty whether the proposed alternatives will change prices for PWC sales or rentals. However, NPS believes that the changes in demand that would occur under these alternatives may result in price changes for PWC-related markets. Thus, losses or gains to tourism-related businesses that may be indirectly affected by the alternative management strategies are included in the benefit-cost analysis.

4.2 RESULTS FOR GULF ISLANDS NATIONAL SEASHORE

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for GUIs. The section discusses the groups most directly affected by the proposed alternatives for management of PWC use in the park and several scenarios for the possible levels of impacts. The benefits and costs accruing to these groups, relative to the baseline (where PWC are banned from GUIs), are then presented.

4.2.1 Affected Groups

For the purpose of this study, six major affected groups, listed in Table 4-3, have been identified:

1. PWC users, in particular those who used PWC in GUIS prior to the 2002 ban and those who may wish to use PWC in GUIS in the future.
2. Other visitors or potential visitors who may have a different experience at the park if PWC remain banned or are otherwise restricted in GUIS (canoeists, anglers, swimmers, hikers, boaters, and other visitors).
3. Producers of PWC services in the area surrounding GUIS who may experience a change in their welfare when PWC use in the park changes (e.g., PWC rental shops, PWC sales shops, restaurants, gas stations, hotels).
4. Local residents of the area surrounding GUIS (not including those in any of the five other user groups).
5. Producers of services for other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare related to the number of PWC users in the park.
6. The general public who may care about the natural resources in GUIS even if they do not visit the park.

The impacts on these groups under each alternative are discussed in more detail below.

Alternatives A and B negatively affect non-PWC park visitors and the general public because PWC use in GUIS is reinstated. PWC users will gain consumer surplus under both of these alternatives.

Alternatives A and B negatively affect non-PWC park visitors and the general public because PWC use in GUIS is reinstated. PWC users will gain consumer surplus under both of these alternatives. NPS estimates that the regulations proposed under Alternatives A and B will slightly increase PWC rental revenues relative to baseline conditions. Local shops with PWC-related revenue will experience gains in producer surplus to the extent that these changes cause PWC users to return to GUIS.

Under Alternatives A and B, NPS expects negative welfare effects for all park visitors and the general public except PWC users and the businesses that cater to them. PWC users, PWC rental and sales shops, and other businesses that provide services to PWC users are expected to experience gains of consumer and producer surplus. Adverse impacts of PWC on beachgoers and other users within

Table 4-3. Impact of Alternatives on User Groups

User Group	Alternative A	Alternative B	Alternative C (No-Action Alternative)
1. PWC users or potential PWC users	<ul style="list-style-type: none"> Consumer surplus is expected to increase as a result of lifting the ban on PWC in GUIS. 	<ul style="list-style-type: none"> Consumer surplus is expected to increase as a result of lifting the ban on PWC use in GUIS, though not as much as in Alternative A because of additional flat wake zones and other restrictions on PWC use. 	<ul style="list-style-type: none"> No change in consumer surplus.
2. Other visitors or potential visitors: canoe users, anglers, other boaters, swimmers, hikers and other visitors	<ul style="list-style-type: none"> Consumer surplus is expected to decrease for current users of GUIS as a result of increased noise, decreased water quality, and an increase in the risk of accidents involving PWC. Consumer surplus is expected to decrease for potential visitors who would have visited GUIS with the ban on PWC use. 	<ul style="list-style-type: none"> Consumer surplus is expected to decrease slightly for current users of GUIS as a result of decreased solitude, decreased water quality, and an increase in the risk of accidents involving PWC, though not as much as in Alternative A because of the flat wake zone 300 yards from all shorelines and other restrictions on PWC use. Consumer surplus is expected to decrease for potential visitors who would have visited GUIS with the ban on PWC use. 	<ul style="list-style-type: none"> No change in consumer surplus.
3. Producers of PWC services: PWC rental shops PWC sales shops other parts of the local economy providing services to PWC users	<ul style="list-style-type: none"> Producer surplus may increase for PWC rental shops. Producer surplus may increase for PWC dealerships as a result of a rise in sales and servicing of PWC. Other parts of the local economy such as hotels, restaurants, and gas stations are not expected to have a significant increase in producer surplus. 	<ul style="list-style-type: none"> Producer surplus may increase for PWC rental shops. Producer surplus may increase for PWC dealerships as a result of a rise in sales and servicing of PWC. Other parts of the local economy such as hotels, restaurants, and gas stations are not expected to have a significant increase in producer surplus. 	<ul style="list-style-type: none"> No change in producer surplus.

(continued)

Table 4-3. Impact of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	Alternative C (No-Action Alternative)
4. Local Residents of the area surrounding GUIS	<ul style="list-style-type: none"> Local residents of nearby areas are not expected to experience a measurable change in welfare. 	<ul style="list-style-type: none"> Local residents of nearby areas are not expected to experience a measurable change in welfare. 	<ul style="list-style-type: none"> No change in welfare.
5. Producers of services for visitors to GUIS who do not use PWC	<ul style="list-style-type: none"> Producer surplus is expected to decrease slightly as lifting restrictions on PWC may result in a small decrease in demand for angling, canoeing, and other activities in the park, resulting in a decreased demand for the provision of services related to these activities. 	<ul style="list-style-type: none"> Producer surplus is expected to decrease as lifting restrictions on PWC may result in a decrease in demand for angling, canoeing, and other activities in the park, resulting in a decreased demand for the provision of services related to these activities. This decrease may be smaller than under Alternative A. 	<ul style="list-style-type: none"> No change in producer surplus.
6. The general public who may care about GUIS even if they do not visit	<ul style="list-style-type: none"> May experience a decrease in welfare as a result of degraded nonuse values resulting from decreased environmental quality in the seashore. 	<ul style="list-style-type: none"> May experience a decrease in welfare as a result of degraded nonuse values resulting from decreased environmental quality in the seashore. The decrease in welfare is expected to be smaller than under Alternative A because of the additional restrictions on PWC use in GUIS. 	<ul style="list-style-type: none"> No change in welfare.

GUIs are increased under Alternatives A and B because PWC will be allowed within the park's boundaries. In addition, allowing PWC in the park should have negative impacts on other boaters' consumer surplus because of the increased probability of accidents between boaters and PWC users and increased noise levels. However, it is possible that congestion will decrease in non-NPS waters and the risk of accidents might actually decrease overall.

Alternative C, which maintains the ban on PWC use, will have no effect on any of the user groups relative to projected baseline conditions.

4.2.2 Scenarios

NPS considers current conditions, a complete ban of PWC in GUIs, to be the baseline with which the alternatives are compared.

To develop estimates of the benefits and costs of the proposed rule under each alternative, NPS used the scenarios described below (see also Section 3.1). NPS considers current conditions, a complete ban of PWC in GUIs, to be the baseline to which the alternatives are compared. It should be noted that under the baseline projections, park-related PWC rentals are assumed to have declined by 100 percent relative to pre-ban levels and park-related PWC sales are assumed to have declined by 75 percent relative to pre-ban levels.

Alternative A

Alternative A allows PWC use in GUIs according to the rules and regulations that were in effect prior to the ban in 2002. For Alternative A, it is expected that PWC users who previously used PWC in the park would return as a result of the regulation. PWC rentals and sales are assumed to return to pre-ban levels under Alternative A.

Alternative B

The second alternative allows PWC use in GUIs with additional flat wake zones near shorelines, West Ship Island Pier, and designated wilderness boundaries but prohibits PWC use within 200 feet of nonmotorized watercraft and people in the water. For this alternative, NPS assumes that PWC sales and rentals will return to 95 percent of pre-ban levels.

Alternative C (No-Action Alternative)

This alternative continues the ban on the use of PWC in GUIs that became effective in April 2002. Under this scenario, NPS assumes no change in PWC rentals or PWC sales relative to the baseline.

4.2.3 Costs

As described in Section 4.1 and Appendix B, PWC use in national parks can be linked to a wide variety of negative impacts. Allowing their use in these parks can therefore result in a number of different costs to society. Section 2.5 specifically describes the impacts on natural resources that are most likely to result from PWC use within the boundaries of GUIs. This section describes how these impacts will be affected by the regulatory alternatives identified above and assesses the costs of these regulations. Assessing these benefits in strictly quantitative (i.e., monetary) terms is not feasible with currently available data; therefore, the costs are described in qualitative terms.

The group of visitors that would bear the largest share of the costs associated with Alternatives A and B would be GUI visitors who do not use PWC and whose park experience would be negatively affected by the use of PWC in the park.

The group of visitors that would bear the largest share of the costs associated with Alternatives A and B would be GUI visitors who do not use PWC and whose park experience would be negatively affected by the use of PWC in the park. In GUIs, other popular activities include canoeing, fishing, boating, camping, swimming, and hiking. As shown in Table 2-2, in 2001 the estimated number of recreational visits to the park was 4,549,900. Based on 2001 NPS PWC use estimates, non-PWC users account for more than 99 percent of visitation.

“Nonusers” of the park are also likely to experience costs as a result of the proposed measures (see Section 4.1 and Appendix B for more details). For example, individuals who do not visit the parks can experience a decline in welfare simply from the knowledge that the natural resources of the park may be degraded by PWC use. Part of this loss may stem from a decreased assurance that the quality of the parks’ resources is being protected for the enjoyment of future generations. Therefore, some of the cost categories described below, in particular those associated with the degradation of unique

park resources and ecosystems, may accrue in the form of nonuse values.¹

Aesthetic Costs—Noise and Visibility Impairments

Alternatives that allow PWC use will increase noise levels in GUIS and reduce the level of natural quiet along portions of the shoreline. They also have the potential to degrade visibility by leading to an increase in the amount of ozone-causing emissions. However, because a large number of motorized boats already operate along the shore in the baseline, the incremental negative impacts of allowing PWC in the park are likely to be negligible.

Alternative A: This alternative will have the greatest impact because it will allow PWC in all areas in GUIS. However, as described above, noise from other boating activities infiltrates the bay and remaining park areas. Because of the small percentage of PWC use compared to other watercraft and impacts from other factors, including automobiles and aircraft, changes to soundscape quality are expected to be minor to moderate, and this alternative is not expected to result in an impairment of soundscape values (NPS, 2003b). It is expected that with improved technology, quieter PWC will become the standard, and sounds generated by PWC will decrease over time.

Alternative B: Detrimental impacts in soundscape quality similar to Alternative A are anticipated under this alternative. This alternative is not expected to result in an impairment of soundscape values.

Alternative C (No-Action Alternative): This alternative continues current policy and offers no change in soundscape relative to current conditions.

Allowing PWC under Alternatives A and B will result in additional aesthetic costs to recreators in the parks, such as canoeists, anglers, birdwatchers, and hikers, relative to baseline conditions. Noise

¹The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

emissions have been identified as a particular nuisance to nonmotorized recreators, such as canoeists and hikers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Anglers using motorized boats also value the natural soundscape, and while fishing, often operate their boats with quiet electric motors to avoid disturbing fish. Therefore, increasing noise from PWC activity in the parks would degrade the experience of both motorized and nonmotorized recreators.

In addition to generating high noise levels, PWC also emit strong-smelling fumes that can be bothersome to other recreators and reduce visibility. These effects tend to be much more localized than noise emissions. Finally, NPS assumes that visibility impacts from PWC emission increases due to allowing PWC under Alternatives A and B will be minor.

Human Health Costs

PWC emissions contain relatively high levels of pollutants such as VOC, CO, PM, NO_x and HCs, which are potentially damaging to human health. It is very unlikely that the level of PWC use in GUIS prior to the ban in 2002 represented a significant health threat to humans; nevertheless, the potential for adverse health effects exists. For example, some of the toxic hydrocarbons are potentially harmful even at very low levels of exposure (EPA, 2000a; EPA, 1999a). The large number of other motorized watercraft that operate in GUIS means that allowing PWC would result in only a small increase in emission levels. In summary, the health costs from the proposed regulations are expected to be negligible for all of the alternatives.

Ecosystem Degradation Costs

As discussed in Sections 2 and 4.1 of this report, PWC use has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural resources are of particular value to the public. Although levels of PWC use prior to the ban in GUIS are not expected to have caused widespread ecosystem damages, allowing PWC in the parks can nonetheless result in costs to visitors and nonusers by potentially degrading some of the parks' natural resources.

Alternative A: This alternative may have some negative impact on water quality. However, in general, allowing PWC in GUIs as proposed under Alternative A is not likely to result in major costs from degrading GUIs's ecosystem because of the prevalence of motorized watercraft other than PWC in GUIs, and impacts to water quality from other nonpoint sources, such that any incremental impacts of PWC are negligible.

Alternative B: This alternative would have some negative impact on water quality, although less than Alternative A. The no-wake and location restrictions would help reduce the effects of PWC on turbidity levels and nearshore loadings of contaminants and minimize physical damage to resources such as SAV beds. These restrictions would also dissuade PWC operators from using these sites. The cumulative effect would be negligible because of the presence of other motorized watercraft.

Alternative C (No-Action Alternative): Because PWC use would still be allowed adjacent to national seashore boundaries, the effects of banning PWC from GUIs would be minimal. This alternative offers no costs to society for ecosystem degradation compared to the current situation.

As discussed in Section 2.5, fish and wildlife may be adversely affected by the use of PWC in the park. In addition to being a potential nuisance to other recreators, noise from PWC may disturb wildlife. Localized, short-term effects on wildlife may occur under Alternatives A and B by increasing noise disturbance and the chance for collisions with wildlife. Although no water quality impacts associated with PWC use in GUIs have been documented, there may be a long-term negative impact to aquatic biota and the ecosystems in the park because of minor degradations in water quality and an increase in physical disturbances.

Introducing potential harm to the park's ecosystems will result in welfare losses for park visitors, for example by decreasing their chances of viewing wildlife in a less stressful environment. It will also result in welfare losses to individuals across the country who value the park's unique ecosystems and natural habitats, regardless of whether they actually visit the park. That is, degrading the park's ecosystems can result in nonuse costs to society.

Safety and Congestion Costs

In addition to environmental costs associated with increases in PWC use, there may also be safety and congestion costs. Since 1990, injuries associated with the recreational use of PWC have increased at least four-fold. The number of injuries reported from PWC use is now higher than that reported from motorboat use in the U.S. (Branche, Conn, and Annest, 1997). Because of the disproportionately large number of injuries associated with PWC use, allowing their use may decrease the safety of park visitors. In addition, the level of congestion is an important factor determining visitor enjoyment. Increases in congestion related to PWC use may therefore have costs to other park users.

Alternative A: Alternative A allows PWC in the park, and it may harm all recreators by increasing their risks of being involved in accidents with PWC. NPS projects moderate to major adverse impacts on visitor conflicts and safety under this alternative (NPS, 2003b).

Alternative B: Potential costs resulting from Alternative B include those discussed for Alternative A, but they may be less severe as a result of no-wake restrictions near shorelines and other areas and prohibiting PWC from operating within 200 feet of nonmotorized watercraft and people in the water. NPS projects negligible to minor adverse impacts on visitor conflicts and safety under this alternative (NPS, 2003b).

Alternative C (No-Action Alternative): This alternative offers no costs to society related to safety and congestion compared to the current situation.

Any increase in accidents that may result from the return of PWC to GUIs will increase the costs to NPS associated with medical/rescue operations, which may require resources to be redirected from other park management activities. However, these costs are not likely to be large in GUIs.

4.2.4 Benefits

PWC users, as well as some businesses in the local area, may experience welfare gains as a result of management alternatives that permit PWC use in the park.

Benefits to PWC Users

Two main groups of PWC users may be affected by the proposed regulations: those who used PWC in GUIS prior to the ban and those who use PWC in substitute areas outside GUIS where PWC users displaced from GUIS may have increased their use since PWC use in GUIS was banned.

For visitors that used PWC in GUIS prior to the ban or who want to ride in the park in the future, allowing PWC use in the park could result in consumer surplus gains.

PWC users who currently ride in nearby areas where displaced riders from GUIS may have visited will gain some consumer surplus if these areas become less crowded because of lifting restrictions on PWC use in GUIS. Although no studies were available that examined the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix B). For PWC users who rode in GUIS prior to the ban or who want to ride in the park in the future, allowing PWC use in the park could result in consumer surplus gains. To the extent that individuals consider other PWC areas, close substitutes, the change in consumer surplus associated with allowing PWC use in the park will be lower. In the case of GUIS, several nearby substitute areas have less stringent regulations (see Section 2.3).

If each individual's demand curve for riding a PWC in GUIS were known, then NPS could add up the gain of consumer surplus for each individual to find the total change in consumer surplus to PWC riders from the proposed regulations. Because the demand curve reflects the individual's preferences for available substitute activities and the cost of these activities, measuring the change in consumer surplus from a trip in the park takes into account substitute activities. In this case, NPS does not know the consumer surplus associated with PWC use in GUIS, nor does NPS know the riders' next best alternative activities.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique. After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and experts at other consulting firms, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found an average value of \$31.98 (1996 dollars)

per person, per day for riding in motor boats in the entire United States (with estimates ranging from \$15 to over \$50). Bhat et al. (1998) calculate an average consumer surplus of \$9.85 (1998 dollars) associated with motorboating and waterskiing in the Northeast and Great Lakes ecoregion. This value is significantly lower than the corresponding values reported for other ecoregions, but it is the most applicable because the other ecoregions examined all consist primarily of small, inland bodies of water that have little in common with the Gulf Coast. Converted to 2001 dollars, the average consumer surplus reported in this study is \$10.70. The estimate comes from a travel cost model based on data from the Public Area Recreation Visitors Study (PARVS). The PARVS data was a multiagency survey that included on-site interviews of recreationists at over 350 sites across the United States between 1985 and 1992. For the benefit transfer, NPS used the value from Bhat et al. (1998) based on the following criteria:

- Waterskiing and motorboating are similar activities to PWC use.
- Bhat et al. (1998) was published in a peer-reviewed journal. The authors estimate a travel cost model using data from on-site interviews and only estimate values for activities in a particular region for which at least 100 observations were collected.

Below NPS discusses the estimated impact of each proposed alternative on PWC users.

Alternative A: This alternative would result in allowing PWC use in GUIs. Those visitors using PWC in GUIs prior to the ban would regain the full value of their consumer surplus for rides in GUIs.

Alternative B: This alternative would result in allowing PWC use with some additional restrictions. Those riders who used PWC in GUIs prior to the ban and would return to GUIs under Alternative B would regain the full value of their consumer surplus for rides in GUIs. Those visitors that used PWC in GUIs prior to the ban but would not return due to the additional restrictions would not experience gains in consumer surplus due to the change in GUIs PWC regulations.

Alternative C (No-Action Alternative): Under Alternative C, NPS anticipates no change in PWC use as a result of the regulation.

Consumer surplus to PWC users will remain unchanged from current conditions.

Using the value of \$10.70 for a day of PWC use, NPS provides an estimate of possible incremental gains in consumer surplus to PWC users as a result of Alternatives A and B.

Using the value of \$10.70 for a day of PWC use, NPS provides an estimate of possible incremental gains in consumer surplus to PWC users as a result of Alternatives A and B. NPS assumes that visitors who return to use PWC in GUIs will gain the full value of consumer surplus associated with a day of PWC use. Table 4-4 summarizes the projected consumer surplus losses for PWC users in GUIs for Alternatives A and B from 2003 to 2012 and the present value (PV) of these losses using both 3 percent and 7 percent discount rates. The PV is the value of a future stream of benefits or costs, discounted to current years. Under Alternative C, there will be no change in PWC use relative to baseline conditions and therefore no change in consumer surplus derived by PWC users.

Table 4-4. Projected Incremental Change in Consumer Surplus for PWC Users under Alternatives A and B, 2003–2012 (2001\$)^a

Year	Alternative A		Alternative B	
	Change in Number of People Using PWC	Change in Consumer Surplus (\$)	Change in Number of People Using PWC	Change in Consumer Surplus (\$)
2003	6,318	\$67,600	6,002	\$64,220
2004	6,924	\$74,090	6,578	\$70,380
2005	7,588	\$81,190	7,209	\$77,130
2006	8,316	\$88,980	7,900	\$84,530
2007	9,114	\$97,520	8,658	\$92,640
2008	9,988	\$106,870	9,489	\$101,530
2009	10,946	\$117,120	10,399	\$111,270
2010	11,996	\$128,360	11,396	\$121,940
2011	13,147	\$140,670	12,489	\$133,640
2012	14,408	\$154,160	13,687	\$146,460
PV(3%) ^b	NA	\$881,530	NA	\$837,460
PV(7%) ^c	NA	\$705,320	NA	\$670,050

^aAll impacts were rounded to the nearest \$10.

^bThe economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584).

^cOffice of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Uncertainty: The estimates of consumer surplus gains to PWC users are uncertain for a variety of reasons. Some of the main sources of uncertainty are as follows:

- The estimate of the number of PWC users who used GUIS prior to the ban is uncertain, as are the projections of future PWC use under Alternatives A and B.
- The actual consumer surplus associated with PWC use in GUIS may be different from the value used in the analysis. The value used in the analysis is based on studies of riding in motor boats and waterskiing in the Northeast and Great Lakes ecoregion, which does not include the Gulf Coast. In addition, the value is based on a full day of motorized water-based recreation. To the extent that PWC users use PWC for only a small fraction of the day, spending the rest of the day engaged in more traditional beach activities, consumer surplus for PWC users may be closer to non-PWC users' surplus value (estimated in Section 4.2.3) than to other motorized watercraft users' surplus.
- The values in Table 4-4 may overstate true gains under Alternative B because of assumptions about the consumer surplus of PWC users who return to ride in the park. In the analysis of Alternative B, PWC users who return to use PWC in GUIS may be inconvenienced by the additional restrictions. These requirements may decrease the consumer surplus associated with using a PWC in GUIS even for those riders who use PWC in the park.
- The 1996 EPA Marine Engine Rule may result in lower PWC use in the future if the cost of new machines increases. If fewer riders would visit the park, the incremental consumer surplus gains associated with Alternatives A and B would be lower.

Benefits to the Local Area Businesses

If PWC use increases as a result of the regulation, then the suppliers of PWC rental, sales, and service will be directly affected. In addition, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders could experience an increase in business from the proposed regulation. The following section describes the approach used to develop quantitative estimates of these impacts and reports the results of the cost analysis for local area businesses.

PWC Sales and Rental Services. NPS identified four PWC rental shops and 13 PWC sales/service shops located in communities near GUIS. Two of these rental shops, both in Pensacola Beach, Florida, indicated that none of their customers use GUIS, and that they had

not been affected by the ban on PWC in GUIs. Two other firms renting PWC were identified, one in Pensacola Beach and the other in Navarre Beach. Only one of these firms was contacted and has experienced minor impacts as a result of the ban on PWC in GUIs. The other firm renting PWC in Navarre Beach was assumed to have experienced similar impacts. NPS did not identify any firms renting PWC near the Mississippi District of GUIs. Four firms selling PWC were identified in Fort Walton Beach, Florida; four in Pensacola, Florida; one in Gulf Shores, Alabama; one in Orange Beach, Alabama; one in Pascagoula, Mississippi; and two in Gulfport, Mississippi.

NPS contacted some of these firms to gather information relevant to this report and to assess the impact the ban on PWC in GUIs has had on their business. Interview data suggest that the PWC dealerships near GUIs have other sources of revenue besides PWC sales. Some of the PWC dealerships sell items such as motorcycles, boats (other than PWC), motor scooters, ATVs, trailers, generators, and outboard motors. Each sales firm contacted implied that its business has been severely affected by the park's decision to ban PWC from GUIs in April 2002. The firm renting PWC indicated that it no longer offers long-term rentals (rentals more than 1 hour) to prevent customers from entering closed areas.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. Purchases made by PWC users contribute to total economic activity in the area surrounding GUIs. It is possible that positive localized impacts on tourism-related businesses located near GUIs will occur if changes in PWC management result in changes in visitation to the recreation area. The proposed restrictions could affect lodging establishments, restaurants, gas stations, and retail stores in the area. These establishments may be affected if the proposed restrictions lead to changes in visitation to the park and surrounding area. However, PWC users comprise a small fraction of total visitation to GUIs, approximately 0.1 percent. Therefore, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a significant change in business under any of the alternatives.

Based on the existing data and interviews with local businesses, NPS expects Alternatives A and B will result in increases in PWC revenue associated with GUIs. The expected increases are

described in Section 3.1. Based on the scenarios outlined in Section 3.1 for each of the alternatives, NPS calculated revenue increases (see Table 3-6).

To translate increased revenue into changes in producer surplus for purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with the rule and return-on-sales measure for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet (D&B). The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between variable costs and revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

The profit ratios, net profit after tax divided by sales, come from D&B (2001).² For instance, the upper quartile profit ratio for sales shops is 4.6 percent and the lowest quartile is 0.6 percent. For rental shops, the upper quartile profit ratio is 8.7 percent and the lowest quartile is –3.4 percent. However, none of the rental shops that NPS interviewed indicated that they had a negative profit margin. Therefore, NPS used the median profit ratio (3.9 percent) in this analysis. Estimated profit ratios for each of the industries expected to be directly affected by PWC restrictions in GUIs are provided in Table 4-5.

For businesses in the GUI region, estimated producer surplus gains associated with imposing the regulatory alternatives relative to the baseline are presented in Table 4-6.³ There are no producer surplus gains expected under Alternative C, the no-action alternative. The majority of the estimated producer surplus gains occur in the PWC sales/service and rental and other retail markets under Alternatives A and B. For Alternative A, estimated producer surplus gains are between \$37,770 and \$289,590 for PWC sales/service and \$14,260

²D&B data for North American Industry Classification System (NAICS) codes are not currently available. Therefore, NPS used the comparable SIC code 5571 (Motorcycle Dealers) as defined by the U.S. Census (i.e., SIC 5571, Motorcycle Dealers) for PWC dealerships. For rental shops, NPS used SIC code 7999 (Amusement and Recreation NEC).

³Estimated producer surplus gains in future years have a similar distribution across industries.

Table 4-5. Profit Ratios Used for Calculating Changes in Producer Surplus

	Profit Ratios		
	SIC	Bottom Quartile	Upper Quartile
PWC rentals	7999	3.9%	8.7%
PWC sales	5571	0.6%	4.6%
Restaurants and bars	5812	0.6%	7.5%
Grocery stores	5411	0.4%	3.0%
Gas and oil	5541	0.1%	3.1%
Souvenir shops and other retail establishments	5947	1.1%	9.9%

Table 4-6. Changes in Producer Surplus in the First Year Resulting from PWC Use Management Alternatives in GUIS (2001\$)^a

	Alternative A		Alternative B		Alternative C	
	Low	High	Low	High	Low	High
PWC rentals	\$14,260	\$31,820	\$13,550	\$30,230	\$0	\$0
PWC sales/service	\$37,770	\$289,590	\$35,250	\$270,280	\$0	\$0
Lodging	\$130	\$1,490	\$120	\$1,350	\$0	\$0
Restaurants and bars	\$90	\$1,140	\$80	\$1,020	\$0	\$0
Groceries/take-out	\$30	\$220	\$30	\$200	\$0	\$0
Gas and oil	\$10	\$220	\$10	\$200	\$0	\$0
Souvenirs and other retail	\$200	\$1,760	\$180	\$1,580	\$0	\$0
Total	\$52,490	\$326,240	\$49,220	\$304,860	\$0	\$0

^aAll impacts were rounded to the nearest \$10. Columns may not sum to totals due to rounding.

to \$31,820 for PWC rentals. Under Alternative B, producer surplus gains are estimated to range from \$35,250 to \$270,280 for PWC sales/service and from \$13,550 to \$30,230 for PWC rentals. The range of gains predicted for the other business categories, which include restaurants and bars, groceries/take-out, gasoline and oil, and souvenir/retail shops is between \$0 and \$1,760 depending on the business category, the alternative, and the profit ratio used. Overall, producer surplus gains are estimated to be between \$52,490 and \$326,240 under Alternative A and between \$49,220 and \$304,860 under Alternative B.

Table 4-7 summarizes the estimated change in producer surplus for the period from 2003 to 2012. The present value of estimated incremental increases in producer surplus for Alternative A ranges from \$664,600 to \$4,130,390 using a 3 percent discount rate and from \$511,870 to \$3,181,200 using a 7 percent discount rate. For Alternative B, the present value of producer surplus increases is estimated to be between \$623,050 and \$3,859,570 using a 3 percent discount rate and between \$479,870 and \$2,972,620 using a 7 percent discount rate. Alternative C, the no-action alternative, continues baseline management of PWC and will not result in changes in producer surplus.

Table 4-7. Changes in Producer Surplus Resulting from PWC Use Management Alternatives in GUIS, 2003–2012 (2001\$)^a

Year	Alternative A		Alternative B		Alternative C	
	Low	High	Low	High	Low	High
2003	\$52,490	\$326,240	\$49,220	\$304,860	\$0	\$0
2004	\$57,530	\$357,540	\$53,940	\$334,100	\$0	\$0
2005	\$63,050	\$391,840	\$59,110	\$366,150	\$0	\$0
2006	\$69,100	\$429,430	\$64,780	\$401,270	\$0	\$0
2007	\$75,730	\$470,620	\$70,990	\$439,760	\$0	\$0
2008	\$82,990	\$515,760	\$77,800	\$481,940	\$0	\$0
2009	\$90,950	\$565,240	\$85,260	\$528,170	\$0	\$0
2010	\$99,670	\$619,460	\$93,440	\$578,840	\$0	\$0
2011	\$109,230	\$678,880	\$102,400	\$634,370	\$0	\$0
2012	\$119,710	\$744,000	\$112,220	\$695,220	\$0	\$0
PV (3%)	\$664,600	\$4,130,390	\$623,050	\$3,859,570	\$0	\$0
PV (7%)	\$511,870	\$3,181,200	\$479,870	\$2,972,620	\$0	\$0

^aAll impacts were rounded to the nearest \$10.

^bThe economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

^cOffice of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Uncertainty

A number of factors will affect local business revenues and the resulting estimates of changes in producer surplus associated with the proposed alternatives. Important factors include the uncertainty surrounding the baseline projections as described in Section 2.2, uncertainty concerning the estimation of output reductions as described in Section 3.3.8, and the use of national average accounting profit ratios to approximate producer surplus gains to individual local businesses.

NPS Enforcement Costs

In addition to costs incurred by PWC users and local businesses under regulation, costs may be incurred by taxpayers to support an increase in enforcement efforts by park staff. Although it is possible that additional staff may be required under Alternatives A and B relative to the baseline, the number of staff (if any) that would be hired is uncertain.

Prior to April 2002, law enforcement activities associated with PWC use at GUIs were incidental to other park services. As described in Section 2.2.2, NPS staff estimate that prior to the ban, PWC made up only 0.5 percent of watercraft in the Florida District of GUIs and 4 percent of watercraft in the Mississippi District. However, as shown in Table 2-1, prior to the ban PWC accounted for 58 percent of all watercraft citations in the Mississippi District of GUIs, while representing less than 5 percent of recreational boats in the Mississippi District (NPS, 2002b).

According to the park, based on informal observation, PWC use in GUIs was increasing rapidly prior to the ban. Table 3-2 shows the sharp increase of PWC registrations in local counties since 1997. Although in the past, the enforcement of PWC regulations has been incidental to other park enforcement activities, without additional data NPS can not be certain that allowing PWC under Alternatives A and B will not necessitate additional enforcement staff in the future. Consequently, NPS does not quantify enforcement costs associated with the implementation of Alternatives A and B. Alternative C, which continues baseline conditions, will not result in any additional enforcement costs for GUIs.

4.3 SUMMARY

Alternative C, the no action alternative, maintains the baseline in this analysis. Under that alternative, all PWC use would remain

prohibited from the park. Alternative A would permit PWC use as managed in the park prior to the ban and Alternative B would permit PWC use, but with additional restrictions compared with pre-ban management. The benefits of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental benefits associated with Alternative C. The primary beneficiaries of Alternatives A and B would be the park visitors who use PWC and the businesses that provide services to PWC users such as rental shops, restaurants, gas stations, and hotels. Additional beneficiaries include individuals who use PWC outside the park where PWC users displaced from the park may decide to ride if PWC use within the park were prohibited. Benefits accruing to individual PWC users are called consumer surplus gains, and those accruing to businesses are called producer surplus gains. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to individuals. These benefits, projected over a 10-year horizon, are summarized in Table 4-8.

Table 4-8. Present Value of Projected Incremental Benefits Under Alternatives A and B, 2003–2012 (thousands)

	PWC Users	Businesses	Total
Alternative A			
Discounted at 3%	\$881.5	\$664.6 – \$4,130.4	\$1,546.1 – \$5,011.9
Discounted at 7%	\$705.3	\$511.9 – \$3,181.2	\$1,217.2 – \$3,886.5
Alternative B			
Discounted at 3%	\$837.5	\$623.1 – \$3,859.6	\$1,460.5 – \$4,697.0
Discounted at 7%	\$670.1	\$479.9 – \$2,972.6	\$1,149.9 – \$3,642.7

As with the benefits described above, the costs of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental costs associated with Alternative C. The primary group that would incur costs under Alternatives A and B are the park visitors who do not use PWC and whose park experiences would be negatively affected

by PWC use within the park. Non-PWC uses at GUIS include boating, canoeing, fishing, and hiking. However, these costs could not be quantified because of a lack of available data. Additionally, the public could incur costs associated with impacts from Alternatives A and B to aesthetics, ecosystem protection, human health and safety, congestion, nonuse values, and enforcement. However, these costs could not be quantified because of a lack of available data.

Because the costs of the alternatives are not quantified, the benefits presented in Table 4-8 represent the quantified net benefits of Alternatives A and B. As noted above, these net benefits do not account for the costs of enforcement; the costs to non-PWC users; or those costs relating to aesthetics, ecosystem protection, human health, and safety, congestion, or nonuse values as a result of a lack of available data. Therefore, these net benefit estimates do not reflect all costs. If all costs could be incorporated, the indicated net benefits for each alternative would be lower.

From an economic perspective, the selection of Alternative B as the preferred alternative is considered reasonable because certain costs could not be quantified in the net benefits presented above. Those costs, relating to non-PWC use, aesthetics, ecosystem protection, human health and safety, congestion, or nonuse values, would likely be greater for Alternative A than for Alternative B. Given that the quantified net benefits of Alternatives A and B are similar, further inclusion of these un-quantified costs could reasonably result in Alternative B having the greatest level of net benefits. Therefore, based on these factors, Alternative B is considered to provide the greatest level of net benefits.

5

Small Entity Impact Analysis

Alternatives A and B are expected to have positive effects on small businesses relative to baseline conditions.

Changes to the management of PWC use in national parks potentially affect the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The Regulatory Flexibility Act (RFA) of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process. To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. This section assesses the potential for PWC regulations in GUIs to affect small businesses. Expected changes in revenues across firms and regional economic impacts are discussed in Section 3 and expected changes in producer surplus are discussed in Section 4.

5.1 IDENTIFYING SMALL ENTITIES

As described in Sections 2 and 3, NPS attempted to identify the firms in the region surrounding GUIs that would experience the most significant impacts as a result of PWC regulations in GUIs. NPS identified four PWC rental shops and 13 PWC sales/service shops located in communities near GUIs. NPS contacted some of these firms to assess the impact that the ban on PWC in GUIs has had on their business and the potential for Alternatives A and B to mitigate this impact.

Based on comments received from these businesses, GUIs was a popular destination for PWC use prior to the ban, but most PWC

users visited other destinations in the area outside of GUIS as well. PWC are sold year-round with the majority of the sales in the late spring/early summer. Interview data suggest that the PWC dealerships near GUIS have other sources of revenue besides PWC sales. Some of the PWC dealerships sold items such as motorcycles, boats (other than PWC), motor scooters, ATVs, trailers, generators, and outboard motors. Each PWC dealership contacted implied that its business has been severely affected by the park's decision to ban PWC from GUIS in April 2002. The firms generally reported PWC revenue losses resulting from the ban on PWC use in GUIS ranging from 35 to 100 percent of pre-ban PWC revenues. In fact, some firms suggested that if the ban continues, they may close their business as a result of the loss in revenues related to PWC.

All of the firms contacted that rent PWC said PWC rentals are their primary source of revenue but that they have other sources of revenue as well. Two of the rental firms suggested that the ban of PWC has not affected their business at all. One firm renting PWC indicated that it no longer offers long-term rentals (rentals more than 1 hour) as a result of the potential for customers to enter closed areas.

In addition to businesses offering PWC sales and service or rental services, the proposed restrictions could potentially affect other businesses such as lodging establishments, restaurants, gas stations, and retail stores in the area. These establishments may be affected if the proposed restrictions lead to changes in visitation to the park and surrounding area. However, because PWC users constitute an extremely small fraction of visitors to the local area, it is very unlikely that there will be any measurable impacts to these businesses by changes in PWC regulations in GUIS, or on the region's tourist industry as a whole.

The SBA's (2002) general size standard definitions classify companies as small based on the following sale criteria:

- NAICS 532292 Recreational Goods Rental¹—\$5 million,
- NAICS 441221 Motorcycle Dealers²—\$5 million,

¹This industry comprises establishments primarily engaged in renting recreational goods, such as bicycles, canoes, motorcycles, skis, sailboats, beach chairs, and beach umbrellas.

- NAICS 445120 Convenience Stores³—\$23 million, and
- NAICS 451110 Sporting Goods Stores⁴—\$6 million.

NPS computed total revenue for each firm in one of the following ways:

- Interview Data—For PWC dealerships that provided an estimate of the number of PWC sold, NPS multiplied that estimate by the average price (\$7,828) of PWC (NMMA, 2002) to obtain PWC revenue. NPS divided this value by the proportion of total revenue that the dealership indicated was derived from PWC sales to obtain an estimate of total firm revenue.
- *infoUSA* Data—NPS used the sales figure reported for the firm by *infoUSA*. If a range was given for the annual sales, the midpoint of the range was assumed to be the best approximation of annual sales.

Based on this approach, NPS estimated the four PWC rental shops and 13 PWC sales/service shops identified had a combined total of approximately \$51 million in annual revenue.

Twelve of these companies are estimated to have less than \$5,000,000 in annual sales (71 percent), one is estimated to have annual sales of \$5,000,000 (6 percent), and four are estimated to have annual sales exceeding \$5,000,000 (24 percent). Using this criterion and sales data, 13 of the 17 firms identified, or 77 percent, are classified as small businesses.

²This industry comprises establishments primarily engaged in retailing new and/or used motorcycles, motor scooters, motor bikes, mopeds, off-road all-terrain vehicles, and personal watercraft, or retailing these new vehicles in combination with repair services and selling replacement parts and accessories.

³This industry comprises establishments known as convenience stores or food marts (except those with fuel pumps) primarily engaged in retailing a limited line of goods that generally includes milk, bread, soda, and snacks.

⁴This industry comprises establishments primarily engaged in retailing new sporting goods, such as bicycles and bicycle parts; camping equipment; exercise and fitness equipment; athletic uniforms; specialty sports footwear; and sporting goods, equipment, and accessories.

5.2 ASSESSMENT

Does the proposed rule have a significant impact on a substantial number of small entities?

Alternative A: No

Alternative B: No

Alternative C: No

After considering the economic impacts of the proposed PWC regulations in GUIs on small entities, NPS concludes that none of the alternatives will have a significant negative impact on a substantial number of small businesses. Alternatives A and B will actually have a positive impact on small businesses in the GUIs region relative to the baseline scenario, under which PWC are banned from the park. The no-action alternative will not have a significant impact on a substantial number of small entities because it will not result in a change from baseline conditions. It is possible that Alternatives A and B could result in a decrease in revenues for businesses that cater to non-PWC users if visitation by non-PWC users declines after PWC return to the park. However, any losses to individual businesses are expected to be very small and total small business revenues are expected to increase. NPS made the determination that these management alternatives would not have a significant negative impact on small entities using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2002) and provides the following factual basis for this determination:

- This rule is not expected to reduce any of the area businesses' profit margins or reduce the competitiveness of the PWC rental and retail businesses.
- NPS projects small increases in revenue relative to the baseline for firms selling and renting PWC to GUIs visitors under Alternatives A and B.
- NPS projects slightly higher overall levels of revenue for other businesses (including restaurants, grocery stores, gas stations, and souvenir shops) in the Gulf Islands region relative to the baseline under Alternatives A and B.
- NPS projects no change in revenue for local small businesses relative to baseline conditions under Alternative C, the no-action alternative.

References

- Arfsten, D.P., D.J. Schaeffer, and D.C. Mulveny. 1996. "The Effects of Near Ultraviolet Radiation on the Toxic Effects of Polycyclic Aromatic Hydrocarbons in Animals and Plants: A Review." *Ecotoxicology and Environmental Safety* 33:1-24.
- Baldwin, M.F. 1970. *The Off-Road Vehicle and Environmental Quality*. Washington, DC: The Conservation Foundation.
- Beal, Diana J. 1994. "Campers' Attitudes to Noise and Regulation in Queensland National Parks." *Australian Parks and Recreation* 30(4):38-40.
- Bhat, G., J. Bergstrom, R. Teasley, J.M. Bowker, and H. Ken Cordell. 1998. "An Ecoregional Approach to the Economic Valuation of Land- and Water-Based Recreation in the United States." *Environmental Management* 22(1):69-77.
- Boardman, A.E., D.H. Greenberg, A.R. Vining, and D.L. Weimer. 1996. *Cost-Benefit Analysis: Concepts and Practice*. Upper Saddle River, NJ: Prentice Hall, Inc.
- Branche, C.M., J.M. Conn, and J.L. Annest. 1997. "Personal Watercraft-Related Injuries: A Growing Public Health Concern." *Journal of the American Medical Association* 278(8):663-665.
- Burger, J. 1998. "Effects of Motorboats and Personal Watercraft on Flight Behavior Over a Colony of Common Tern." *The Condor* 100(3):528-534.
- Bury, R.B., and R.A. Luckenbach. 1983. "Vehicular Recreation in Arid Land Dunes: Biotic Responses and Management." In *Environmental Effects of Off-Road Vehicles: Impacts and Management in Arid Regions*, R.H. Webb and H.G. Wilshire, eds., pp. 207-221. New York: Springer-Verlag.
- Bury, R.L., R.C. Wendling, and S.F. McCool. 1976. *Off-Road Recreation Vehicles—A Research Summary 1969-1975*. Report MP1277. College Station, TX: The Texas Agricultural Experiment Station.

- California Air Resources Board. 1999. "Fact Sheet: New Regulations for Gasoline Marine Engines." <http://www.arb.ca.gov/msprog/marine/facts.pdf>. As obtained on December 10, 2001.
- Chestnut, L.G., and R.D. Rowe. 1990. *Preservation Values for Visibility Protection at the National Parks: Draft Final Report*. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC.
- Coughlin, C.C., and T.B. Mandelbaum. 1991. "A Consumer's Guide to Regional Economic Multipliers." *Federal Reserve Bank of St. Louis* January/February:19-32.
- Dun & Bradstreet. 2001. *Industry Norms & Key Business Ratios. Desk-Top Edition*. Murray Hill, NJ: D&B.
- Dunn, D.R. 1970. "Motorized Recreational Vehicles—On Borrowed Time." *Parks and Recreation* 5(7):10-14, 46-52.
- EDAW. 2003. Nicole Korbe, EDAW, Inc. April 16, 2003. Personal Communication with Charles Pringle, RTI.
- Federal Aviation Administration (FAA). January 2000. *Regulatory Evaluation, Regulatory Flexibility Analysis, International Trade Impact Assessment, and Unfunded Mandates Assessment: Commercial Air Tour Limitation in the Grand Canyon National Park Special Flight Rules Area*. Washington, DC: FAA.
- Federal Register*. 1996. "Environmental Protection Agency: 40-CFR, parts 89, 90 and 91. Air Pollution Control; Gasoline Spark Ignition Marine Engines; New Nonroad Compression-Ignition and Spark Ignition Engines, Exemptions; Rule." *Federal Register* 61(194). October 4, 1996.
- Florida Department of Environmental Protection (FDEP). 2002. Watershed Management, Florida Department of Environmental Protection, Northwest District Watershed Management Program, Water Quality Spotlight for the Pensacola Bay Watershed. <http://www.dep.state.fl.us/northwest/ecosys/waterquality/pensacolabay.htm>. 2002.
- Florida Department of Environmental Protection (FDEP). 2003. Watershed Management, Florida Department of Environmental Protection, Northwest District Water Quality Outlook, Updated January 21, 2003. <http://www.dep.state.fl.us/northwest/ecosys/waterquality/Outlook.htm>. Date January 29, 2003.

- Florida Fish and Wildlife Commission. 2003. "Boating Accident Statistics." <<http://floridaconservation.org/law/boating/>>. As accessed March, 2003.
- Freeman, III, A.M. 1993. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, DC: Resources for the Future.
- Hamilton, J.R., N.K. Whittlesey, M.H. Robison, and J. Ellis. 1991. "Economic Impacts, Value Added, and Benefits in Regional Project Analysis." *American Journal of Agricultural Economics* 73(2):334-344.
- infoUSA. 2002. "ReferenceUSA: An infoUSA Service." <<http://www.referenceUSA.com>>. As obtained in June 2002.
- Ivy, M.I., W.P. Stewart, and C. Lue. 1992. "Exploring the Role of Tolerance in Recreational Conflict." *Journal of Leisure Research* 12:348-360.
- Kado, N.Y., R.A. Okamoto, J. Karim, and P.A. Kuzmicky. 2000. "Airborne Particle Emissions from 2- and 4-Stroke Outboard Marine Engines: Polycyclic Aromatic Hydrocarbon and Bioassay Analyses." *Environmental Science and Technology* 34:2714-2720.
- Komanoff, Charles, and Howard Shaw. 2000. "Drowning in Noise: Noise Costs of Jet Skis in America." <<http://www.nonoise.org/library/drowning/drowning.htm>>.
- League for the Hard of Hearing. 1996-1999. "Noise Levels in our Environment Fact Sheet." <<http://www.lhh.org/noise/decibel.htm>>. As obtained in October 2000.
- Lucas, R.C., and G.H. Stankey. 1974. "Social Carrying Capacity for Back-Country Recreation." In *Outdoor Recreation Research: Applying the Results*. pp. 14-23. Report 6TR-NC9. USDA Forest Service.
- MACTEC Engineering and Consulting of Georgia, Inc (f/k/a/ LAW Engineering and Environmental Sciences, Inc.), BBL Sciences, and RTI. April 2002a. "Economic Analysis of Personal Watercraft Regulations in Glen Canyon National Recreation Area." Draft report prepared for the National Park Service.
- MACTEC Engineering and Consulting of Georgia, Inc (f/k/a/ LAW Engineering and Environmental Sciences, Inc.), BBL Sciences, and RTI. September 2002b. "Economic Analysis of Personal Watercraft Regulations in Lake Meredith National Recreation Area." Draft report prepared for the National Park Service.

- MACTEC Engineering and Consulting of Georgia, Inc (f/k/a/ LAW Engineering and Environmental Sciences, Inc.), BBL Sciences, and RTI. January 2003. "Economic Analysis of Personal Watercraft Regulations in Lake Mead National Recreation Area." Final report prepared for the National Park Service.
- Malm, William C. 1999. *Introduction to Visibility*. Prepared under Cooperative Agreement CA2350-97-001: T097-04, T098-06. Fort Collins, CO: Cooperative Institute for Research in the Atmosphere, NPS Visibility Program.
- Mekenyan, O.G., G.T. Ankley, G.D. Veith, and D.J. Call. 1994. "QSARs for Photoinduced Toxicity 1. Acute Lethality of Polycyclic Aromatic Hydrocarbons to *Daphnia magna*." *Chemosphere* 28:567-582.
- Michael, Jeffrey A., and Stephen D. Reiling. 1997. "The Role of Expectations and Heterogenous Preferences for Congestion in the Valuation of Recreation Benefits." *Agricultural and Resource Economics Review* 27(October):166-173.
- Money Generation Model—Version 2 (MGM2). 2002. <<http://www.msu.edu/user/stynes/npsmgm/>>. As obtained July 2002.
- National Center for Environmental Research (NCER), J.T. Oris, S.I. Guttman, and G.A. Burton. 1999. *Ecological Assessment of the Phototoxic Polycyclic Aromatic Hydrocarbon Fluoranthene in Freshwater Systems*, EPA Grant Number R823873).
- National Marine Fisheries Service (NMFS). Guidelines for Economic Analysis of Fishery Management Options. <<http://www.nmfs.noaa.gov/sfa/prorules.html>>. Last updated August 2000.
- National Marine Manufacturers Association (NMMA). 2002. "Annual Retail Unit sales Estimates." *Boating 2001*. National Marine Manufacturers Association. <www.nmma.org>. As obtained July 11, 2002.
- National Park Service (NPS). 1999. *Statistical Abstract 1999*. Denver, CO: National Park Service.
- National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO: National Park Service.
- National Park Service (NPS). "Effects of Visual Air Quality on Visitor Experience." <<http://www2.nature.nps.gov/ard/vis/visitexp.htm>>. As obtained on October 25, 2000b.

- National Park Service (NPS). 2002a. Director's Order 77. <<http://www2.nature.nps.gov/nps77/natresguidesb.html>>.
- National Park Service (NPS). 2002b. Administrative Determination: To Allow 36 CFR 3.24(a) (2000), Use of Personal Watercraft in Park Waters, to Take Effect in Gulf Islands National Seashore. Gulf Islands National Seashore, 2002.
- National Park Service (NPS). 2002c. NPS Visitations Database—Park Report. Park Visitation Report, Gulf Island NS. <http://www2.nature.nps.gov/npstats/parkrpt.cfm> Date 10/2/2002.
- National Park Service (NPS). 2003a. Personal communication between Charles Pringle, RTI International and Nina Kelson, Deputy Superintendent, GUIS.
- National Park Service (NPS). 2003b. *Gulf Islands National Seashore Personal Watercraft Use Environmental Assessment*. Draft. Washington, DC: National Park Service.
- National Transportation Safety Board (NTSB). 1998. *Personal Watercraft Safety*. Safety Study NTSB/SS-98/01. Washington, DC.
- O'Riordan, T. 1977. "Sharing Waterspace: How Coarse Fish Anglers and Boat Users React to One Another." *Proceedings of the Recreational Freshwater Conference*. UK: Water Research Centre.
- Office of Management and Budget (OMB). 1992. Regulatory Impact Guidance. Appendix V of Regulatory Program of the United States Government. April 1, 1991–March 31, 1992.
- Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.
- Oris, J.T., A.C. Hatch, J.E. Weinstein, R.H. Findlay, P.J. McGinn, S.A. Diamond, R. Garrett, W. Jackson, G.A. Burton, and B. Allen. 1998. "Toxicity of Ambient Levels of Motorized Watercraft Emissions to Fish and Zooplankton in Lake Tahoe, California/Nevada, USA." Poster number 3E-P005, presented at the 8th Annual Meeting of the European Society of Environmental Toxicology and Chemistry (SETAC-Europe), Bordeaux, France.
- Overseas Marketing Group (OMGSIC). "Hearing Problems and Diseases." <<http://www.omgsic.com/2.4v.htm>>. As obtained on October 9, 2000.

- Pearce, D., and D. Moran. 1994. *The Economic Value of Biodiversity*. London: Earthscan Publication.
- Personal Watercraft Industry Association (PWIA). 2002. <http://www.pwia.org/Abo_PWC.htm>. As obtained on January 23, 2002.
- Rodgers, J.A., and H.T. Smith. 1997. "Buffer Zone Distances to Protect Foraging and Loafing Waterbirds from Disturbance by Personal Watercraft in Florida." *Wildlife Society Bulletin* 25(1):139-145.
- Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.
- Schmidt, M., U.S. Coast Guard. September 4, 2001. Personal communication with RTI.
- Sheridan, D. 1979. *Off-Road Vehicles on Public Land*. Washington, DC: Council on Environmental Quality.
- Stynes, Daniel. 2000. "Economic Impacts of Tourism." <<http://www.msu.edu/course/prr/840/econimpact/pdf/ecimpvol1.pdf>>. As obtained on October 15, 2000.
- Stabler, J.C., G.C. Van Kooten, and N. Meyer. 1988. "Methodological Issues in the Evaluation of Regional Resource Development Projects." *Annals of Regional Science* 22:13-25.
- Stynes, Daniel. 2000. "Economic Impacts of Tourism." <<http://www.msu.edu/course/prr/840/econimpact/pdf/ecimpvol1.pdf>>. As obtained on October 15, 2000.
- Tjarnlund, U., G. Ericson, E. Lindesjoo, I. Petterson, and L. Balk. 1995. "Investigation of the Biological Effects of 2-Cycle Outboard Engines' Exhaust on Fish." *Marine Environmental Research* 39:313-316.
- Tjarnlund, U., G. Ericson, E. Lindesjoo, I. Petterson, G. Akerman, and L. Balk. 1996. "Further Studies of the Effects of Exhaust from Two-Stroke Outboard Motors on Fish." *Marine Environmental Research* 42(1):267-271.
- U.S. Bureau of Economic Analysis (BEA). 2003. U.S. Department of Commerce, Regional Accounts Data. "Bearfacts." <<http://www.bea.gov/bea/regional/bearfacts/>>.
- U.S. Bureau of Labor Statistics. 2000. Consumer Price Index. Series CUUR000SA0. <<http://146.142.24/cgi-bin/surveymost>>. As obtained on October 26, 2000.

- U.S. Bureau of Labor Statistics. 2002. Consumer Price Index. Series ID CUUR000SA0. <<http://146.142.24/cgi-bin/surveymost>>. As obtained on January 23, 2002.
- U.S. Bureau of the Census. 2002. "Geography Quick Report." available at http://factfinder.census.gov/servlet/GQRGeoSearchByListServlet?ds_name=E9700A1&_ts=62698136020, accessed 12/19/02.
- U.S. Environmental Protection Agency (EPA). 1974. "Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." EPA 550/9-74-004, U.S. EPA, Washington D.C.
- U.S. Environmental Protection Agency (EPA). 1993. EPA Fact Sheet: Automobiles and Ozone. <<http://www.epa.gov/otaq/04-ozone.htm>>.
- U.S. Environmental Protection Agency (EPA). 1994. "The Effects of Marine Engine Exhaust Emissions on Water Quality: Summary of Findings of Various Research Studies." Office of Air and Radiation.
- U.S. Environmental Protection Agency (EPA). 1997. *The Benefits and Costs of the Clean Air Act, 1970 to 1990*. Washington, DC: U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency (EPA). 1999a. *1997 National Air Quality: Status and Trends*. Washington, DC: Office of Air and Radiation.
- U.S. Environmental Protection Agency (EPA). *OAQPS Economic Analysis Resource Document*. <<http://www.epa.gov/ttnecas1/econdata/Rmanual2/manual.htm>> Last updated April 1999b.
- U.S. Environmental Protection Agency (EPA). Integrated Risk Information System. <<http://www.epa.gov/ngispgm3/iris/index.htm>>. As obtained on October 15, 2000a.
- U.S. Environmental Protection Agency (EPA). 2000b. "Recreational Vehicles, Marine Engines." Region III, Air Protection Division. Available at <http://www.epa.gov/reg3artd/vehicletran/vehicles/recreational_vehicles.htm>.
- U.S. Small Business Administration (SBA). 2002. "Tables of Size Standards." Office of Size Standards. <<http://www.sba.gov/size/index/size.html>>. As obtained September 5, 2002.
- VanMouwerik, M., and M. Hagemann. 1999. "Water Quality Concerns Related to Personal Watercraft Usage." Technical paper. Water Resources Division, Fort Collins, CO.

Wagar, J.A. 1977. "Recreational Carrying Capacity." In *Proceedings of the Wildland Recreation Conference*. pp. 168-175. Edmonton, Alberta: University of Alberta.

Wisconsin Department of Natural Resources (WDNR), Bureau of Integrated Science Services. 2000. "The Effects of Motorized Watercraft on Aquatic Ecosystems."

Appendix A: Economic Impact Analysis

Expenditures made by visitors to national parks have a variety of economic impacts on the region where the park is located. For instance, tourists contribute to sales, profits, jobs, tax revenues, and income in a region. The most direct effects are felt within the primary tourism sectors: lodging, dining, transportation, entertainment, and retail trade. However, when indirect effects are included, almost all sectors of the economy are affected by tourism. This occurs because spending by tourists on the primary tourist sectors leads those sectors to purchase inputs into their production process from other industries, which then purchase more inputs themselves and so on. In addition, as local household income rises because of the impact of tourism, these households purchase more goods and services from many different industries. This leads to higher incomes for households deriving income from these other industries, which causes them to purchase more goods and services as well. These feedback effects continue indefinitely, but become smaller and smaller in each round as a result of leakage because not all income is spent within the regional economy. These effects on household spending are known as induced effects.

A simple example from Stynes (2000) illustrates this point. Assume a region attracts an additional 100 tourists, each spending \$100 per day. The direct impact of this increase in tourism is \$10,000 per day in new spending. If sustained over a season of 100 days, the region would experience an increase in sales of \$1 million. This spending would primarily take place in the lodging, dining, entertainment, and retail sectors in proportion to how each visitor spends his/her \$100. Not all of the value of this spending can be

assumed to accrue within this region because the cost of goods made in other regions should not be included as a direct sales effect in the local area. For example, gasoline purchased by tourists for \$1.50 per gallon should not be included as a local spending impact of \$1.50 per gallon. Instead, only the retail margin on the gasoline can be considered a direct effect of tourism spending. The margins on gasoline are relatively small. Assuming a retail margin of 12 percent suggests that the direct impact of spending on gasoline to the local area is only about 18 cents per gallon. Wholesale margins are also included for wholesalers located within the region of interest.

Returning to the example above, perhaps 30 percent of the million dollars in direct spending would leak out of the area to cover the costs of goods purchased by tourists that were produced outside the region. The remaining \$700,000 increase in direct sales might yield \$350,000 in income within tourism-related industries and support 20 jobs directly linked to tourism. Tourism industries tend to be labor intensive, translating a relatively high proportion of sales into income and jobs.

The tourism industry buys goods and services from other industries located in the area to provide the goods and services offered to tourists. For example, changes in sales, jobs, and income in the linen industry (an industry supplying products to hotels) will result from changes in hotel sales. Also, as mentioned above, this industry is typically very labor intensive. Therefore, most of the \$350,000 in income will be paid as wages and salaries to tourism industry employees. As a result of this increase in income, these employees will spend more in the local region for an array of household products and services. Assuming a sales multiplier of 2.0 to indicate that each dollar of direct sales generates another dollar of secondary sales implies that the \$700,000 in direct sales within the region leads to a \$1.4 million increase in regional sales as a result of the additional tourists visiting the area. These secondary sales create additional income and employment in the region, with the estimated impact dependent on the multipliers for each particular region. Assume in our case that the total impact of the increase in tourism after applying multipliers is \$1.4 million in sales, \$650,000 in income and 35 jobs.

Although hypothetical, the numbers used in this example are fairly typical of those used in a tourism economic impact study. Through indirect and induced effects, changes in tourist spending can affect almost every sector of the economy to some extent. The magnitude of these effects depends strongly on the extent to which businesses and households in the region purchase goods and services from local suppliers as well as how much household income is affected by the changes in spending. When a large employer closes a plant, the entire local economy may be negatively affected as retail stores close and leakages of spending from the region increase as consumers go outside the region for more of their goods and services. Similar effects in the opposite direction are observed when a new facility opens and there is a significant increase in household income (Stynes, 2000).

In addition to simply estimating the total regional impact, more detailed studies identify the sectors that receive the direct and secondary effects. They may also identify distinct market segments and identify differences in spending and impact between these subgroups. This information is sometimes used to target marketing efforts towards tourists with particular characteristics that are likely to lead to the largest economic impact per marketing dollar. It may also be used simply to better understand the distribution of impacts and to gain a better measure of the expected effects of a change in regional spending. Effects on tax revenues may also be examined by applying local tax rates to changes in sales and income.

The economic impacts resulting from a change in spending are typically measured by

- estimating the change in the number and types of visitors to the region due to the proposed change in policy,
- estimating average levels of spending (often within market segments) of visitors in the local area, and
- providing the estimated change in direct spending as input into a regional economic model to determine secondary effects.

Estimates of changes in visitor activity usually come from a demand model or professional judgment about the changes in visitation likely to take place. This step is often the weakest link in tourism impact studies because most regions do not have accurate counts of

visitors, let alone models for predicting changes in visitation (Stynes, 2000).

Spending averages are usually derived from visitor surveys or may be adapted from other similar studies. Because of differences in visitors, these data are often provided for different segments of the visitor population due to variations in spending patterns based on whether visitors stay overnight, the accommodations they choose, the type of transportation they are using, and other characteristics of their stay.

One of the primary methods used to estimate the secondary economic impacts of a particular action or policy is to apply an input-output (I-O) model. I-O models are mathematical models that describe the relationship between sectors in a region's economy. Regional I-O models are commonly used to estimate the benefits or costs of an event on the economy of a given region. These models are used to estimate linkages among sectors of the economy such that an event directly affecting one sector of the economy can be traced through the impact on the entire regional economy. This approach permits estimation of both the direct impacts in the affected sector as well as indirect impacts that occur as the change in spending by the directly affected industry works its way through the economy. Based on production functions estimating the inputs that each industry must purchase from every other industry to produce their output, these models predict flows of money between sectors. These models also determine the proportion of sales that end up as income and taxes. Multipliers are estimated from I-O models based on the estimated recirculation of spending within the region. The higher the propensity for households and firms within the region to purchase goods and services from local services, the higher the multipliers for the region will be. A number of important assumptions are involved in using I-O models. Some of the basic assumptions include the following:

- **Constant Returns to Scale.** Each industry's production function is assumed to have constant returns to scale. This means that, to produce additional output, all inputs increase proportionately (i.e., if output in an industry were to double, then that industry would double its use of all inputs). Because labor is one of the inputs into production, this implies that jobs will change in exactly the same proportion as output.

- **No Supply Constraints.** Supplies are unlimited. All industries have access to unlimited quantities of raw materials at a constant price with output limited only by demand.
- **Fixed Commodity Input Structure.** This assumption implies that price changes do not cause a firm to purchase substitute goods. This structure assumes that changes in the economy affect the industry's output but not the mix of inputs it uses to make its products.
- **Homogeneous Sector Output.** The proportion of all the commodities produced by an industry will remain the same, regardless of total output. An industry will not increase the output of one product without proportionately increasing the output of all its other products.
- **Industry Technology Assumption.** This assumption is important when data are collected on an industry-by-commodity basis and then converted into industry-by-industry data. It assumes that an industry uses the same technology to produce all of its products. In other words, an industry has a primary product and all other products are by-products of the main product.
- **Identical Firms.** All firms in a given industry employ the same production technology and produce identical products.
- **Model Parameters.** The various model parameters are accurate and represent the current year. These models rely on the national system of accounts to generate model parameters based on standard industrial classification codes and various federal government economic censuses. They are usually at least a few years out-of-date, although this is not usually a major problem unless the region has changed significantly.
- **Induced Effects.** Multiplier computations for induced effects assume that jobs created by additional spending are new jobs involving local households. The induced effects of new spending are calculated assuming linear changes in household spending with changes in income.

These assumptions are necessary to estimate an economic impact model using a typical regional I-O model. However, these assumptions lead to several limitations as noted by Hamilton et al. (1991); Coughlin and Mandelbaum (1991); and Stabler, Van Kooten, and Meyer (1988), among others. Most of these issues apply to alternative models as well and should be considered in interpreting the results of economic impact analyses in general. Some of the biggest limitations associated with this type of analysis are discussed below.

First, all production inputs have an associated opportunity cost. Thus, these opportunity costs should be included in the net benefits calculation, although this is often not considered in an economic impact analysis. Net benefits equal impacts less opportunity costs. In the case of full employment, perfect resource mobility, and absence of scale economies, benefits of a policy, action, or project would be zero because all factors employed as a result could have received the same return without the policy, action, or project in alternative uses. Typically, applications analyzing regional economic analysis assume that there is not full employment and complete mobility in the region being analyzed, but the change in net benefits will still be reduced if opportunity costs are considered.

Another issue is that multipliers estimate short-term changes, ignoring a regional economy's long-term adjustments. Thus, most of the economic effects identified in economic impact analysis are likely to be only transitory as the regional economy adjusts to the change. For example, if jobs are lost in a region because of new regulations, some of this reduction will be temporary because some of the workers whose jobs were eliminated will find new jobs in the region.¹

Also, if some workers relocate in response to a change in the regional economy, then it is not entirely clear who should be counted in the region when calculating the benefits and costs associated with a change. For example, a new project located in a particular region may attract resources from outside the region. It is not clear that income to these immigrant resources should be counted as regional benefits of the project because people originally from the region do not benefit. However, I-O models typically make no distinction between jobs and sales, for example, going to those people already within the region and benefits going to those people outside the region.

Furthermore, applying multipliers is difficult if industries will move to different points on their cost curves as a result of the change and there are economies or diseconomies of scale. Because I-O models are based on fixed coefficients, they are not able to capture these

¹Some workers may not find jobs within the region, even in the long run. The loss of workers who leave for jobs in other regions may tend to slow the region's growth, but such restructuring ultimately improves national economic performance by redistributing resources to their most efficient use.

impacts. These models assume that there are no supply constraints such that industries will not change their relative purchases from other sectors. This requires excess regional production capacity and excess regional labor so that use of these resources can be increased without a change in prices. In many areas, this is unlikely to be the case. Instead, increasing scale may lead to an increase in the price of labor and other resources and may cause a change in the mix of inputs used for production. It may also lead to the use of a different proportion of inputs being purchased from outside the region, which will affect the estimated change in final demand for regional output.

Some additional difficulties with applying regional multipliers include the following:

- multipliers are based on political boundaries (e.g., counties, states) instead of economic areas;
- multipliers may not be constant over time;
- different production functions for different activities are lumped together; and
- information on the relationships between producers in a region is lacking, which makes constructing an accurate set of multipliers very difficult.

Despite these caveats on the use of multipliers, regional I-O models are still considered the best way currently available to cost-effectively estimate the regional impacts of a change that will affect the local economy.

Appendix B: Social Benefits and Costs of Personal Watercraft Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. That is, it assesses whether the action generates benefits to society (gains in social welfare) that are greater than the costs (losses in social welfare). The following sections provide detailed descriptions of the range of social benefits and social costs that may result from PWC restrictions and discuss the ways in which these benefits and costs can be conceptualized and measured.

B.1 SOCIAL BENEFITS OF PWC RESTRICTIONS

PWC use in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, PWC use can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

B.1.1 Environmental Benefits

The use of PWC may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with PWC use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing PWC use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of PWC is the level of sound they emit during normal operation. PWC have been measured to emit 65 to 105 decibels (dB) per unit, which may disturb visitors on the land and on the water. Noise limits established by NPS require vessels to operate at less than 82 dB at 82 feet (from the shoreline). The amount of noise from a PWC can vary considerably depending on its distance from another park visitor and whether it is in the water or in the air. Noise dissipates by 5 dBs for each doubling of distance from a 20-foot circle around the source and a PWC that is airborne is 15dB louder than one that is in the water (Komanoff and Shaw, 2000). To put these noise-level estimates into perspective, Table B-1 also compares them with those of other familiar sounds. Vehicle noises are measured at a distance of 50 feet, but at varying speeds.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Noise impacts from PWC use are caused by frequent changes in pitch and loudness due to rapid acceleration, deceleration, and change of direction. PWC noise intrudes in

Table B-1. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
PWC	65–105
Normal conversation	60
Normal breathing	10

Sources: League for the Hard of Hearing, 2000; Overseas Marketing Group (OMGSIC), 2000.

otherwise quiet soundscapes, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, and kayakers) causes conflicts between users.

Those who are most likely to benefit from reductions in PWC-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in recreational activities that take place by the water, such as fishing, hiking, birdwatching, canoeing, kayaking, and swimming.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Several studies have found disamenities associated with various forms of mechanized recreational activities or other “technology-related” noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O’Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GRCA) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from \$37 to \$92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor-day values would be reduced in

relation to the how much aircraft noise interfered with the enjoyment of GRCA. Information about how aircraft noise affected different recreators was provided by a separate survey study of GRCA visitors. The survey found, for example, that for backcountry visitors 21 percent were “slightly” affected and 2.5 percent were “extremely” affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was “slightly,” “moderately,” “very,” or “extremely” affected by the noise.

Another example of such a study that focuses specifically on the noise impacts of PWC is one that has examined the losses that PWC users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between \$10 for a popular beach and \$30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. The assumptions about the size of the decrease in value from increases in noise come from studies on the increased property values for houses in quiet neighborhoods. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between \$0.50 and \$7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

Other evidence regarding the noise-related losses imposed by PWC can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of PWC. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of \$22.3 (in 1990 dollars) per visit if they encountered more groups than expected.

Visibility Improvements. Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors’ (and nonvisitors’) enjoyment and appreciation of national parks. Nevertheless, visual air quality has been and continues to be threatened at many national parks across the country. Emissions

from PWC in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Although visibility effects can be characterized and measured in several different ways, “regional haze,” which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributors to regional haze and visibility impairments in general are small particles (particulate matter or PM) in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the U.S. (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and PWC), account for the largest portion of NO_x emissions, which contribute to nitrates.

Emissions factors per hour are not available for PWC but because PWC are powered by the same type (two-stroke) of engine as snowmobiles, snowmobile emissions factors may serve as a reasonable proxy. Table B-2 compares typical emissions rates for snowmobiles and other vehicles for NO_x and PM. These are the pollutants that are the most likely contributors to visibility impairments from PWC emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. The California Air Resources Board found that a 7-hour ride on a PWC powered by a conventional two-stroke engine produces the same amount of smog-forming emissions as over 100,000 miles driven in a modern passenger car. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table B-2 suggest that PWC can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be negligible. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table B-2. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_x and PM

	NO _x	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive ^a)	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive ^a)	3.22	0.26

^aAssuming an average speed of 25 mph.

Source: NPS, 2000a.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. One study in particular (Chestnut and Rowe, 1990) found that the average household in the southeast U.S. would be willing to pay \$68 (in 1999 dollars) per year for a doubling of the visual range in national parks in the southeast U.S.

Human Health Benefits

In addition to NO_x, ozone, and PM, PWC emissions typically contain a number of other pollutants, including CO, a conventional air pollutant that is commonly associated with mobile sources. It also includes a number of potentially toxic HC pollutants—benzene, 1,2-butadiene, formaldehyde, and acetaldehyde—and ammonia. As described in Table B-3, inhalation of these pollutants is associated with a wide variety of potential adverse health effects.

The extent to which the health effects listed in Table B-3 result from PWC emissions depends on the level and duration of exposure. For comparative purposes, Table B-4 compares emissions rates of HCs and CO for snowmobiles (as in Table B-2, snowmobile emissions factors serve as a proxy for those of PWC) and for other vehicles.

The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors

Table B-3. Health Effects Associated with Pollutants in PWC Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO _x)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Butadiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available

Sources: EPA, 2000a; EPA, 1999a.

Table B-4. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO

	HC	CO
Snowmobiles (lbs per 4 hr visit)	19.84	54.45
Automobiles (lbs per 4 hr drive ^a)	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive ^a)	1.23	4.45

^aAssuming an average speed of 25 mph.

Source: NPS, 2000a.

recreating near areas where PWC use is permitted may be exposed to particularly high levels of CO and certain HCs.

Restrictions on PWC use in national parks could potentially reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects, in particular those effects described in Table B-3. As previously mentioned, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table B-5 provides a summary of “unit” values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals’ average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing PWC use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table B-5. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999\$) ^a
Acute bronchitis	\$57
Acute asthma	\$41
Acute respiratory symptoms	\$23
Shortness of breath (one day)	\$6.8

^aAll amounts inflated using the consumer price index available from the U.S. Bureau of Labor Statistics, 2000.

Ecosystem Protection Benefits

To the extent that damages to park ecosystems occur, their cumulative effect is to reduce the “ecological services” that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique biological, cultural, and geological resources and the recreational and other services they provide. A vast majority of park visitors

(i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, fishing, as well as using PWC). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran [1994] for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

B.1.2 Nonenvironmental Benefits

Restrictions on PWC use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

With the increase in PWC use in recent years has come an increased concern relating to the health and safety of operators, swimmers, snorkels, divers, and other boaters. A study conducted by the National Transportation Safety Board (NTSB) in 1998 revealed that although recreational boating fatalities have been declining, PWC related fatalities have increased in recent years (NTSB, 1998). PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities. Within the U.S. five PWC-related fatalities occurred in 1987 and 68 PWC-related fatalities occurred in 2000. However, the peak occurred in 1997, with 84 PWC-related fatalities. Since 1997, PWC-related accidents, injuries, and fatalities have decreased. Following this same pattern, the percentage of PWC out of all boats involved in accidents have decreased from 36.3 percent in 1996 to 29.6 percent in 2000. The increases and decreases in PWC

accidents, injuries, and fatalities are comparative to the number of PWC sales and number of PWC owned (Schmidt, 2001).

Restrictions on PWC use in national parks would certainly reduce the number of such incidents in the parks.¹ The primary beneficiaries would be the PWC users themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section C.2) that these recreators experience as a result of the restrictions.² Other summer recreators (non-PWC) might also benefit if they would otherwise be at risk of being involved in accidents with PWC. In addition, PWC accidents can impose costs on NPS and other local state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in PWC accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing PWC in national parks requires NPS to develop, maintain, and operate an infrastructure to support these activities. In particular launch sites and buoys must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of PWC use permitted.

By restricting PWC use, some of these infrastructure-related costs can be avoided or reduced. As a result some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

¹The benefits of these reductions may be offset to some degree by increased PWC usage and accidents in areas outside the parks.

²To the extent that PWC users are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from using a PWC. This implies that the safety benefits to these individuals from reducing PWC use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

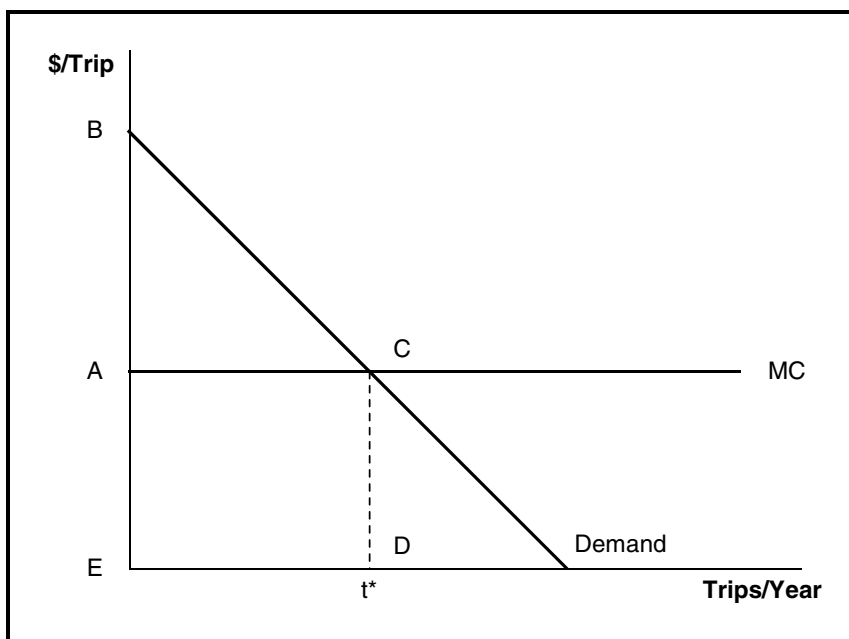
B.2 SOCIAL COSTS OF PWC RESTRICTIONS

The primary losses associated with PWC use restrictions in national parks will accrue to

- PWC users, in particular individuals who will not PWC in the park as a direct result of the restrictions, and
- providers of PWC-related services for park visitors.

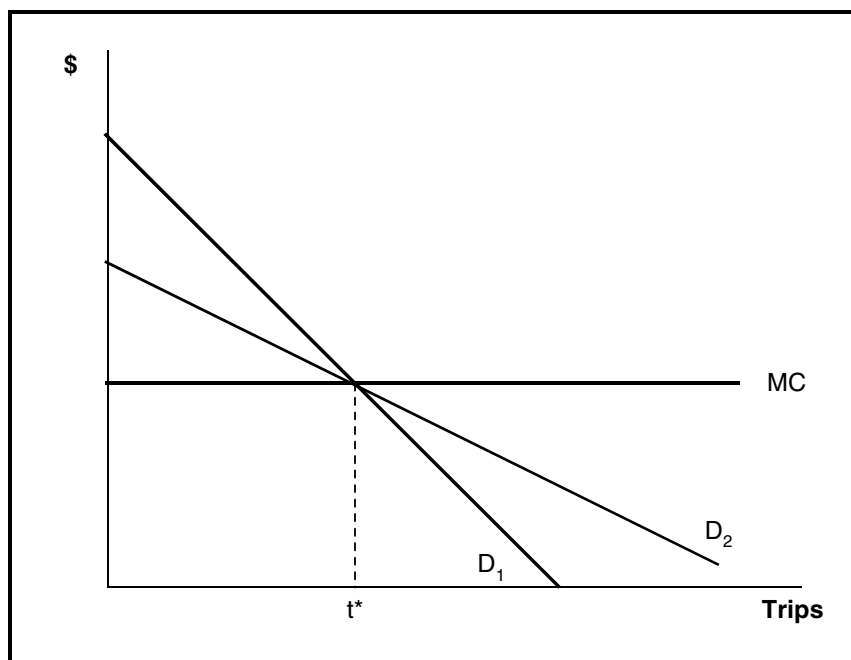
The welfare losses to individual consumers (PWC riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure B-1 depicts an individual demand curve for PWC trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t^* . The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure B-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure B-2 depicts two alternative demand curves for PWC trips to a particular waterbody. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2 , indicates that this individual has a variety of close substitutes for PWC use in this area (these substitutes could include PWC riding in a different area or participating in a different activity such as motorboating). The individual with the steeper demand curve, D_1 , has fewer substitute activities he/she enjoys as much as using his/her PWC in this waterbody. If both individuals choose the same number of trips, as in Figure B-2, the person with the steeper demand curve, D_1 (fewer substitutes for PWC use) receives greater consumer surplus from use in this particular waterbody and thus will experience a greater loss in welfare if the waterbody is closed.

Figure B-2. Consumer Surplus and Substitute Activities



The change in welfare for businesses is measured by producer surplus, or the area AP^*B in Figure B-3, where P^* is the market price of the good, for example a PWC rental. Producer surplus measures the difference between total revenue and variable costs. If the firms face an upward-sloping marginal variable cost (MC) curve, then a decrease in demand, indicated in Figure B-4 from D to D' will result in a lower producer surplus for PWC rental companies.

Figure B-3. Producer Surplus

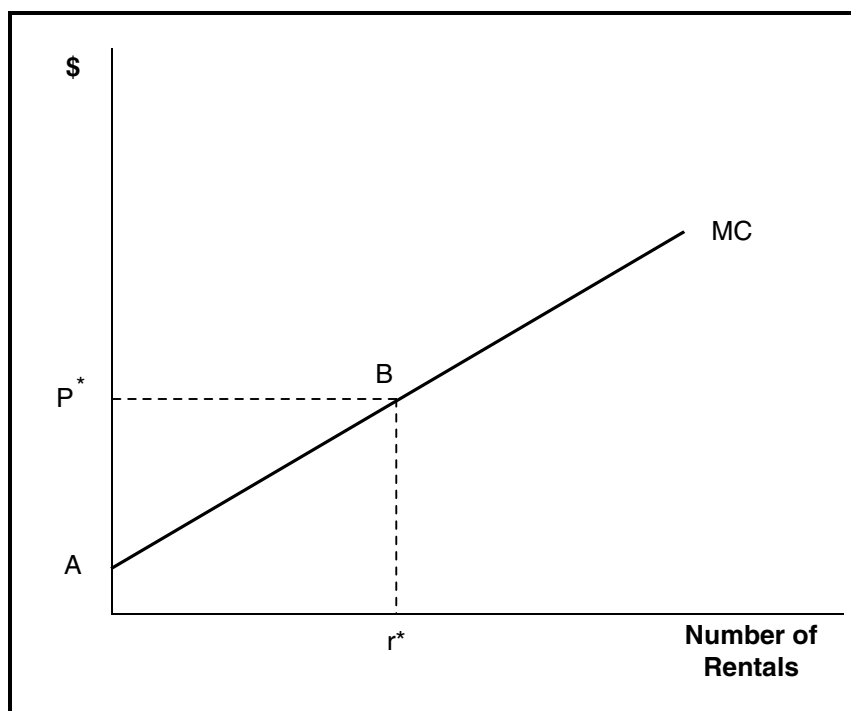
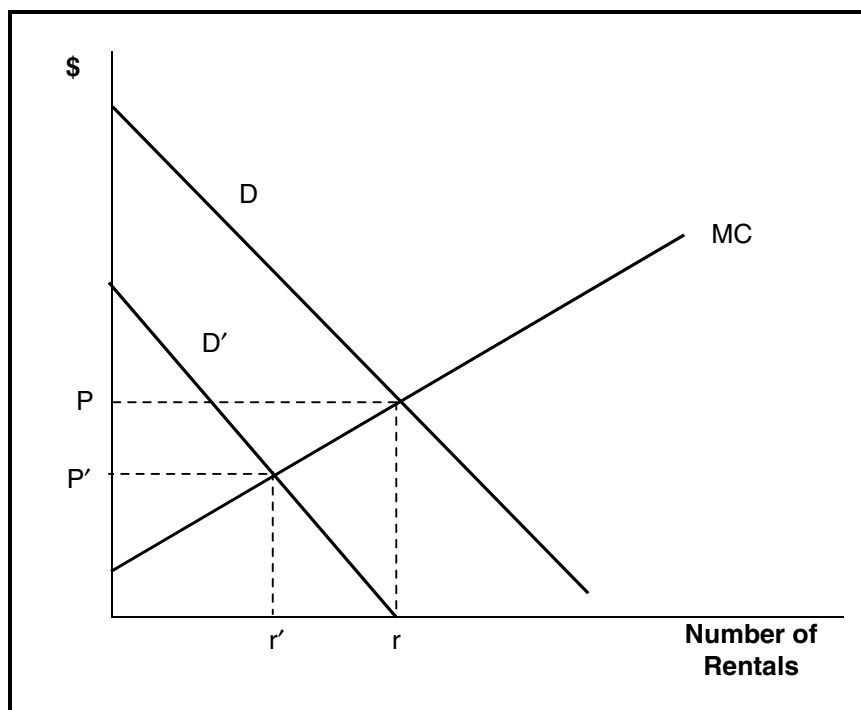


Figure B-4. Producer Surplus and a Change in Demand



If PWC riding decreases as a result of the regulation, then the suppliers of PWC and other tourism-related services will be affected, including rentals and sales of PWC and PWC accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of recreation related rentals increases, then some businesses may experience an offsetting increase in producer surplus.